

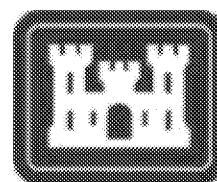
**FINAL  
WORK PLAN  
with  
QUALITY ASSURANCE PROJECT PLAN**

**SMALLMOUTH BASS ACOUSTIC TELEMETRY AND TISSUE  
SAMPLING AND CRAYFISH TISSUE SAMPLING**

**at  
River Operable Unit, Bradford Island  
CASCADE LOCKS, OREGON**

Prepared by

U.S. ARMY CORPS OF ENGINEERS  
Portland and Seattle Districts



**August 14, 2020**

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**TITLE AND APPROVAL SHEET**  
**WORK PLAN WITH QUALITY ASSURANCE PROJECT PLAN (WP-QAPP)**  
**SMALLMOUTH BASS ACOUSTIC TELEMETRY AND TISSUE SAMPLING AND**  
**CRAYFISH TISSUE SAMPLING**

**RIVER OPERABLE UNIT, BRADFORD ISLAND, CASCADE LOCKS, OREGON**

This Work Plan with Quality Assurance Project Plan (WP-QAPP) describes sampling activities and Data Quality Objectives (DQOs) for smallmouth bass and crayfish sampling at the River Operable Unit, Bradford Island, Cascade Locks, OR. The QAPP is based on the *Intergovernmental Data Quality Task Force Uniform Federal Policy for Quality Assurance Project Plans Guidance (EPA 2009)*.

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## TABLE OF CONTENTS

<b>1. PROJECT MANAGEMENT AND OBJECTIVES.....</b>	<b>9</b>
1.1. Project Organization, Responsibilities and Authority .....	9
1.1.1. Communication Pathways.....	10
1.1.2. USACE Personnel Responsibilities and Qualifications .....	12
1.1.3. Technical Advisory Group Personnel Responsibilities and Qualifications .....	13
1.2. Project Planning.....	13
1.2.1. Project Planning (Scoping) .....	13
1.2.2. Problem Definition, Site History, and Background .....	13
1.3. Project Quality Objectives and Measurement Performance Criteria .....	14
1.3.1. Development of Project Quality Objectives Using the Systematic Planning Process .....	14
1.3.2. Measurement Performance Criteria .....	19
1.4. Secondary Data Evaluation.....	19
1.5. Project Overview and Schedule.....	19
<b>2. DATA GENERATION AND ACQUISITION.....</b>	<b>21</b>
2.1. Sampling Tasks.....	21
2.1.1. Sampling Process Design and Rationale .....	21
2.1.2. Sample Collection Procedures .....	22
2.1.3. Sample Naming Convention .....	24
2.1.4. Decontamination Procedures .....	25
2.1.5. Field Equipment Calibration, Maintenance, Testing and Inspection Procedures .....	25
2.1.6. Supply Inspection and Acceptance Procedures.....	25
2.1.7. Field Documentation Procedures .....	25
2.1.8. Sample Delivery.....	26
2.1.9. Sample Custody .....	27
2.2. Analytical Tasks .....	27
2.2.1. Analytical Methods .....	27
2.2.2. Analytical Instrument Calibration Procedures .....	27
2.2.3. Analytical Instrument and Equipment Maintenance, Testing, and Inspection Procedures ..	27
2.3. Quality Control Samples .....	27
2.3.1. Field Quality Control Samples.....	28
2.3.1.1. <i>Field Duplicates</i> .....	28

2.3.1.2. <i>Trip Blanks</i> .....	28
2.3.1.3. <i>Equipment Rinse Blanks</i> .....	28
2.3.2. Analytical Method Quality Control Samples .....	28
2.3.2.1. <i>Method Blanks</i> .....	28
2.3.2.2. <i>Laboratory Control Samples (LCS)</i> .....	28
2.3.2.3. <i>Matrix Spike and Matrix Spike Duplicate (MS/MSD)</i> .....	28
2.3.2.4. <i>Surrogates</i> .....	29
<b>3. ASSESSMENT AND OVERSIGHT .....</b>	<b>29</b>
<b>4. DATA MANAGEMENT AND DOCUMENTATION.....</b>	<b>30</b>
4.1. WP-QAPP.....	30
4.2. Final Report .....	30
4.3. Laboratory Documentation (Data Package Deliverables) .....	30
4.3.1. Data Package Deliverables.....	30
4.3.2. Electronic Data Reporting Formats.....	30
<b>5. DATA REVIEW, VERIFICATION, AND VALIDATION .....</b>	<b>31</b>
5.1. Review of Data .....	31
5.2. Data Verification and Validation Stages .....	31
5.2.1. Stage 1 .....	32
5.2.2. Stage 2A .....	32
5.2.3. Stage 2B .....	33
5.2.4. Stage 3 .....	34
5.2.5. Stage 4 .....	35
5.3. Data Verification and Validation Stages .....	35
5.4. Usability Assessment.....	36
5.4.1. Precision.....	37
5.4.2. Accuracy .....	37
5.4.3. Representativeness .....	37
5.4.4. Completeness .....	37
5.4.5. Sensitivity.....	37
<b>6. REFERENCES .....</b>	<b>37</b>

## **LIST OF TABLES**

Table 1. Project Organization and Distribution List.....	10
Table 2. Communication Pathways .....	11
Table 3. Analytical Laboratories, Contacts, and Analyses .....	13
Table 4. Project Quality Objectives.....	16
Table 5. Sample Locations, Media, Methods, Analytes of Interest, and Detection and Reporting Limits .....	18
Table 6. Sampling Summary (Number of Primary and Quality Control Samples) <sup>1</sup> .....	19
Table 7. Project Tasks .....	20
Table 8. Estimated Project Schedule .....	20
Table 9. Approximate GPS coordinates for crayfish traps at Reference and Site.....	23
Table 10. Methods, Sample Containers, Volumes, Preservation, and Holding Times for Crayfish and Smallmouth Bass Tissue Samples.....	25

## **LIST OF FIGURES**

Figure 1. Project Organization Chart.....	9
Figure 2. Smallmouth bass, signal crayfish, and sculpin .....	22

## **APPENDICIES**

Appendix A: Summary of historic tissue results for bass and crayfish
Appendix B: Implementation Plan
Appendix C: Maps
Appendix D: Statistical Analysis
Appendix E: Field Forms
Appendix F: Job Hazard Analysis (JHA)
Appendix G. ERDC 153 Congeners with Detection Limits and Reporting Limits
Appendix H. Dry ice sample packing and shipping

## **LIST OF ACRONYMS**

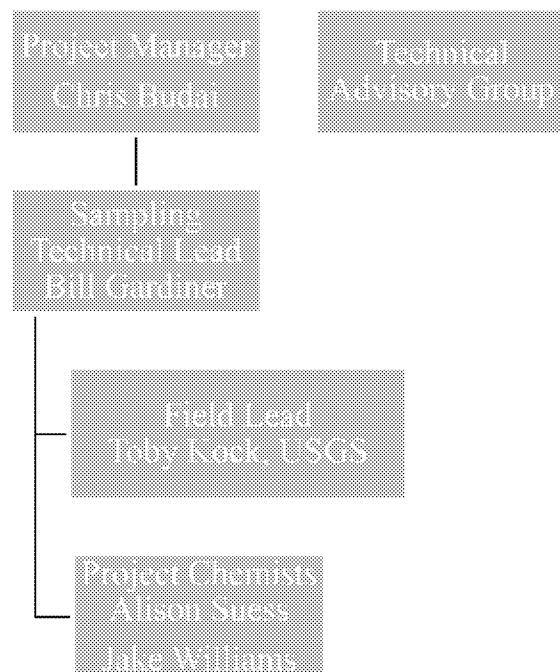
µg/L	microgram per liter
ARI	Analytical Resources, Inc.
CCB	continuing calibration blank
CCV	continuing calibration verification
CoC	chain of custody
CPR	cardiopulmonary resuscitation
DL	detection limit
DOD ELAP	Department of Defense Environmental Laboratory Accreditation
DOD QSM	Department of Defense Quality Systems Manual
DMC	deuterated monitoring compounds
EDD	electronic data deliverables
EPA	United States Environmental Protection Agency
GC-MS	gas chromatography mass spectroscopy
HAZWOPER	Hazardous Waste Operations and Emergency Response
ICB	initial calibration blank
ICV	initial calibration verification
JHA	Job Hazard Analysis
LCS	laboratory control sample
mg/kg	milligram per kilogram
MS	matrix spike
MSD	matrix spike duplicate
ODEQ	Oregon Department of Environmental Quality
OU	Operable Unit
PCB	polychlorinated biphenyl
PDT	Project Delivery Team
POC	point of contact
PM	Project Manager
PQO	Project Quality Objectives
QC	quality control
RI	Remedial Investigation
RL	reporting limit
SLV	screening level value
SOP	Standard Operating Procedure
SSHP	Site Safety Health Plan
TAG	Technical Advisory Group
UCL	upper confidence limit
UPL	upper prediction limit
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
UFP-QAPP	Uniform Federal Policy Quality Assurance Project Plan
WP-QAPP	Work Plan with Quality Assurance Project Plan

# **1. PROJECT MANAGEMENT AND OBJECTIVES**

## **1.1. Project Organization, Responsibilities and Authority**

The Project Delivery Team (PDT) for this Work Plan with Quality Assurance Project Plan (WP-QAPP) includes members from the US Army Corps of Engineers (USACE) Portland and Seattle Districts as well as the US Geological Survey (USGS).

The project team provides the overall framework for the data collection approach by defining project objectives and data quality requirements, and ensuring that they are met during the execution of the project. Project updates will be shared with the Technical Advisory Group (TAG) who will be provided final copies of the WP-QAPP by the USACE Project Manager (PM). The roles of the project team members are described further in this section. Organization of the project is presented in Figure 1 and Table 1.



**Figure 1.** Project Organization Chart

**Table 1.** Project Organization and Distribution List

Personnel	Contact Information	Title
		USACE
<b>Chris Budai</b>	333 SW 1st Ave Portland, OR 97204 Phone: 503-808-4725 Email: christine.m.budai@usace.army.mil	Project Manager
<b>Bill Gardiner</b>	4735 E. Marginal Way S Seattle, WA 98134 phone: 206-764-3322 William.W.Gardiner@usace.army.mil	Technical Lead
<b>Alison M. Suess, Ph.D.</b> <b>Jake Williams</b>	4735 E. Marginal Way S Seattle, WA 98134 phone: 206-764-3264 alison.m.suess@usace.army.mil phone: 206-316-3157 Jacob.a.williams@usace.army.mil	Project Chemists (primary and backup)
<b>Toby Kock</b>	5501A Cook-Underwood Rd Cook, WA 98505 Phone: 509-538-2915 tkock@usgs.gov	Field Lead

### 1.1.1. Communication Pathways

Communication is a key to the success of this project. Communication pathways describe the points of contact for resolving sampling and analysis problems, for distributing data to users, soliciting concurrence and obtaining approval between project personnel and contractors. Communication pathways are summarized in Table 2.

**Table 2.** Communication Pathways

<b>Communication Driver</b>	<b>Responsible Entity</b>	<b>Name Phone Number</b>	<b>Procedure (timing, pathway, etc.)</b>
USACE management for this project  Overall direction and Point of Contact for public	Project Manager	Chris Budai 503-808-4725	Assures that the overall direction of the project is consistent with USACE guidance  Liaison with the Public
QAPP approval  Schedule, budget and technical issues  Changes to schedule and budget  Oversight of final report  Provides coordination among team members  Ensures compliance with Site USGS Safety Plan and AHA (or another USACE representative)  Delivery of samples to laboratory (or another USACE representative)	Technical Lead	Bill Gardiner 206-764-3322	Coordinates with Project Manager, Project Lead, Chemist and Field Lead on project technical issues  Reports to USACE PM regarding schedule, budget, and technical issues  Notifies USACE PM of significant changes in execution or schedule  Oversee USACE writing of final report and distribution to reviewers  Provides input to QAPP and data reports  Briefs field team on AHA and documents noncompliance  Coordinates with Project Chemist and laboratory for sample delivery
Writes QAPP with input from technical team members.  Laboratory and data validation	Project Chemists	Alison M. Suess, Ph.D. 206-764-3264  Jake Williams 206-316-3157	Oversees writing of QAPP and Job Hazard Analysis (JHA) and ensures revision approval within agreed timeframe  Oversees laboratory work  Writes data validation report  Provides laboratory and data validation components of QAPP
Provide direction to field teams on sample collections  Sampling activities summary	Field Lead	Toby Kock  Kristen Kerns 206-764-3474	Daily communication with team members during sampling events  Documents all field activities in Final Monitoring Report  Coordinates with Project Chemist

## **1.1.2. USACE Personnel Responsibilities and Qualifications**

### **USACE Project Manager**

The project manager (PM), Chris Budai, is responsible for the execution of the scope, schedule, and budget for the Bradford Island project. She is the primary POC for communications with stakeholders. The USACE PM also has the authority to stop work of USACE staff. The USACE PM is the primary document controller for the WP.

### **USACE Technical Lead**

The Technical Lead, Bill Gardiner, will oversee all activities of the USGS and USACE PDT, including quality assurance reviews, and maintain regular coordination to ensure adequate and timely flow of information for all work. The technical lead, or another USACE representative in the field, will serve as the site safety and health officer (SSHO) for this effort and coordinate daily field safety briefings.

### **USACE Project Chemists**

The Project Chemist, Alison M. Suess, Ph.D. (backup: Jake Williams) is directly responsible for laboratory coordination and matters related to chemistry. They are responsible for providing additional guidance to the Field Sampling Lead (Toby Kock) in any matters relating to sampling, project chemistry and data quality.

### **Field Sampling Lead/Site Health and Safety Officer**

Toby Kock and Kristen Kerns are the designated field sampling lead. They are responsible for coordinating the sampling with relevant Bonneville Project staff and execution of sampling. They may communicate directly with the PM, Technical Lead, and Project Chemists as needed during the field sampling event.

### **Special Training Requirements and Certifications**

Project staff shall be qualified to perform their assigned jobs. Field sampling personnel conducting or monitoring sampling activities are to be trained by the field sampling lead in accordance with established USACE protocols.

### **Field Staff**

All project staff participating in on-site field activities shall have current HAZWOPER training in accordance with 29 Code of Federal Regulations (CFR) Part 1910.120, or be directly supervised by personnel with current HAZWOPER training. The technical lead and/or field sampling lead has HAZWOPER training in accordance with the same standard as well as a current certification in first aid and CPR. All field personnel responsible for packing and shipping samples using dry ice also have training and certification in accordance with 49 CFR 172.704 and the IATA Dangerous Goods regulation.

### **Laboratory Contact**

The analytical laboratories and applicable information that will be used for this project are listed below. In Table 3.

**Table 3.** Analytical Laboratories, Contacts, and Analyses

Lab Name and Sample Type	Lab Address	POC	Contact Info	Role
U.S. Army Engineer Research and Development Center (ERDC)  Bass and Crayfish Samples	USACE ERDC EL EPC B3299 3909 Halls Ferry Road Vicksburg, MS 39180	Primary: Jenifer Milam Netchaev	Jenifer.m.netchaev@erdc.dren.mil Jenifer.m.netchaev@usace.army.mil 601-634-7431	Project Manager, Research Chemist
		Alternate: Tony Bednar	Anthony.J.Bednar@usace.army.mil 601-634-3652	Laboratory Director, Research Chemist
Analytical Resources, Inc. (ARI)  Bait Samples	Analytical Resources, Inc. 4611 S. 134th Place, Suite 100 Tukwila, WA 98168-3212	Kelly Bottem	kelly.bottem@arilabs.com 206-695-6211	Client Services Manager

### **1.1.3. Technical Advisory Group Personnel Responsibilities and Qualifications**

TAG members represent their respective agencies and provide technical review of the QAPP.

## **1.2. Project Planning**

### **1.2.1. Project Planning (Scoping)**

Several planning meetings were held within USACE and with TAG members. Topics discussed in these meetings include:

- Schedule
- Sampling Design and Data Collection
- Analytes

The outcomes of the meetings are documented by incorporation into this WP-QAPP.

### **1.2.2. Problem Definition, Site History, and Background**

USACE conducted a Remedial Investigation and draft Feasibility Study for the in water portion of Bradford Island, known as the River Operable Unit (OU), in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 Executive Order 12580. As part of the Feasibility Study process, USACE conducted a baseline risk assessment, which found

unacceptable risk to human health and the environment from exposure to PCB contaminated sediment in the River OU.

Field efforts performed between 2006 and 2011 in support of the Remedial Investigation sampled smallmouth bass and found elevated levels of PCBs in some of these fish. PCBs in crayfish tissues from the Site were also elevated, relative to the reference area (Appendix A). . During the feasibility study, USACE conducted supplemental passive porewater sampling and sediment trap deployment in 2017 and 2018. This sampling effort included underwater video survey, with underwater images of the river bottom along the northern shoreline of Bradford Island showing minimal sediment and large cobbles and boulders. This lack of sediment raised concern regarding the continued presence of contaminated sediment and the validity of the CSM developed in support of the FS. Subsequently, USACE began collecting data to update the CSM for the River OU. The intent of this data is to help inform the current site conditions for the River OU to aid in development of remedial action alternatives in the feasibility study

In 2020, USACE conducted additional in-situ porewater sampling to better understand the location of potential primary source contamination along the northern shoreline of Bradford Island. As part of the reevaluation and update to the CSM, tissues of fish and invertebrates are being sampled for chemical analysis. Bass represent an important resident prey species for human health via the fish ingestion pathway. Crayfish and clams are both important invertebrate species with limited home range that provide a localized estimate of uptake, food web transfer, and source.

This QAPP provides the approach and methods for sampling and analysis of bass and crayfish. Based on the length of time since previous fish sampling, USACE believes more current fish tissue sampling and tracking is needed to help inform the conceptual site model for the River OU and understand where bass exposure may be occurring. Crayfish will be also collected during this effort.

USACE has contracted with the USGS to collect smallmouth bass and crayfish samples for tissue analysis and tagging and to evaluate the movements of smallmouth bass near Bonneville Dam using acoustic telemetry.

### **1.3. Project Quality Objectives and Measurement Performance Criteria**

#### **1.3.1. Development of Project Quality Objectives Using the Systematic Planning Process**

Project Quality Objectives (PQOs) are developed through the systematic planning process as described in the UFP-QAPP Guidance. PQOs specify the type, quantity, and quality of data needed to ensure that project data can be used for the intended purpose to answer specific environmental questions, support environmental decisions, and determine technical activities that will be conducted. The PQOs developed for this project are described in Table 4.

The overall goal of this tissue collection effort and telemetry is to update and confirm the conceptual site model presented in the Remedial Investigation. Given the amount of time since previous tissue sampling efforts in 2011, coupled with the recent visual observations of the complex river bottom along the northern shoreline of Bradford Island, USACE believes this effort is prudent to undertake as part of the feasibility study process to inform remedial alternative development and selection. The results of this data

will be looked at comprehensively with other data associated with clam tissue, passive sampling, and future sediment sampling. In light of the length of time since previous sampling efforts, this data may be used to update the risk assessment and provide current risk communications to tribal and recreational fishers in the area. The intent is not to redo the baseline risk assessments, but supplement the dataset to reflect current conditions.

The analytes for tissues were selected based on their high contribution to Site risks. PCBs provide a direct indication of historical contamination at Bradford Island from the disposal of PCB containing transformers. PCB contamination has historically been identified in every sampled media at the site and also contributes a majority of risk to both ecological and human health receptors. Organochlorine pesticides were identified for analysis in tissue based on concentrations in bass tissue that contributed a notable fraction to overall risk. However, there is uncertainty if the elevated concentrations are attributable to site exposures or the result of matrix interferences during analysis. As such, analysis for organochlorine pesticides for this field effort will help to confirm its role in risk. Lastly, mercury is ubiquitous at elevated concentrations throughout this portion of the Columbia River. However, given previous industrial activities at the site and associated risk, current mercury concentrations will be evaluated as part of this effort.

The PQOs are written for only bass and crayfish. However, sculpin will also be collected incidentally as part of angling and trap efforts then archived. Sculpin provide a more localized estimate of uptake into fish tissues and will be used to supplement the CSM. A QAPP amendment will be issued once additional funding becomes available and chemical analysis is deemed pertinent based on the results of the field effort and analysis of bass and crayfish.

**Table 4.** Project Quality Objectives

<b>Step 1: State the Problem</b>	<b>Step 2: Identify the Goals of the Study</b>	<b>Step 3: Identify Information Inputs</b>	<b>Step 4: Define the Boundaries of the Study</b>	<b>Step 5: Develop the Analytic Approach</b>	<b>Step 6: Specify Performance or Acceptance Criteria</b>	<b>Step 7: Develop the Detailed Plan for Obtaining Data</b>
1) Are there any significant differences in River OU (Site) bass or crayfish concentrations relative to reference concentrations?	Evaluate differences between tissue concentrations at the Site versus reference area.  Understand site concentrations and magnitude of impacts from the site relative to concentrations representative of un-impacted receptors.  Update and reconfirm conceptual site model.	The evaluation will use results from the analysis of samples collected in the Site and analysis of samples representative of reference concentrations.  Reference concentrations for bass will be determined by fish collected near Bonneville Dam that are from a separate population than those bass impacted by contamination from Bradford Island. Bass collected from previous sampling efforts (2011 and earlier) that represent reference population concentrations will also be compared. Information from other sampling efforts for bass in the Columbia River may also be considered.  Reference concentrations for crayfish will be represented by composites collected upstream of Stevenson, WA.	Tissue samples will be analyzed for the analytes of interest.  For bass, sample locations will focus on the northern shoreline of Bradford Island, Goose Island, and the Forebay up to RM 147.  For crayfish, samples will be collected around Bradford Island, Goose Island, the Oregon shoreline, and upstream near Stevenson, WA.	Statistical comparison between Site versus reference value(s) to determine significant differences.  Visual evaluation of data and statistical outlier test.	See Data Usability Assessment (Section 5.1).	See Sampling Design, Location, and Methods (Sections 2.1).
2) Are there any changes in tissue concentrations for bass or crayfish collected from the Site over time?	Evaluate changes in tissue concentrations of target analytes at the Site for bass and crayfish collected during 2006 (Site), 2007/2008 (reference), and 2011 and tissue collected in 2020.  Confirm current conditions relative to previous information in order to update the conceptual site model.	The evaluation will use results from the analysis of samples collected in the Site in 2020 relative to samples collected between 2006 and 2011. Potential temporal changes for the reference concentrations/area will also be assessed.	Tissue samples will be analyzed for analytes of interest.  Sample locations will focus on the Site and reference concentrations/area.  Historic data includes collection efforts in 2006 (Site), 2007/2008 (reference), and 2011 relative to the 2020 sampling effort.	Statistical comparison for data collected over time, both RI and post RI data.	See Data Usability Assessment (Section 5.1).	See Sampling Design, Location, and Methods (Sections 2.1).

<b>Step 1: State the Problem</b>	<b>Step 2: Identify the Goals of the Study</b>	<b>Step 3: Identify Information Inputs</b>	<b>Step 4: Define the Boundaries of the Study</b>	<b>Step 5: Develop the Analytic Approach</b>	<b>Step 6: Specify Performance or Acceptance Criteria</b>	<b>Step 7: Develop the Detailed Plan for Obtaining Data</b>
3) Where are bass potentially exposed to PCB contaminated sediment in the Site? How do bass move through different parts of the Site? How do bass move between different areas of the site, including the north shore of Bradford Island and Goose Island?	Evaluate movement of bass as an indicator of where PCB exposure may occur.	The evaluation will use results from acoustic telemetry of approximately 40 smallmouth bass tracked in the Site.	Bass within the Site will be tracked with acoustic telemetry.  Initial capture locations for tagging will be focused in the Site.	Telemetry data analyzed using SAS Statistical Software.	See Data Usability Assessment (Section 5.1).	See Sampling Design, Location, and Methods (Sections 2.1).

**Table 5.** Sample Locations, Media, Methods, Analytes of Interest, and Detection and Reporting Limits

Sample Locations and Media	Method	Analytes	Tissue DL	Tissue RL
Site and Reference Area Bass and Crayfish Tissue	PCB Congeners, EPA 8082 Modified (ERDC) with subset EPA 1668C (ERDC commercial subcontractor)	153 PCB congeners (ERDC) with subset 209 PCB congeners (ERDC commercial subcontractor)	0.015 - 0.075 ( $\mu\text{g}/\text{kg}$ ww) (ERDC)	0.10 - 0.03 ( $\mu\text{g}/\text{kg}$ ww) (ERDC) with subset 0.20 - 0.60 ( $\mu\text{g}/\text{kg}$ ww) (ERDC commercial subcontractor)
Site and Reference Area Bass and Crayfish Tissue	Organochlorine Pesticides, EPA 8081 (ERDC)	Organochlorine Pesticides	( $\mu\text{g}/\text{kg}$ ww)	( $\mu\text{g}/\text{kg}$ ww)
		2,4'-DDD	0.16	0.5
		2,4'-DDE	0.16	0.5
		2,4'-DDT	0.16	0.5
		4,4'-DDD	0.16	0.5
		4,4'-DDE	0.16	0.5
		4,4'-DDT	0.16	0.5
		alpha-BHC	0.16	0.5
		beta-BHC	0.16	0.5
		delta-BHC	0.16	0.5
		gamma-BHC	0.16	0.5
		alpha-Chlordane (cis)	0.16	0.5
		gamma-Chlordane (trans)	0.16	0.5
		Dieldrin	0.16	0.5
		Endosulfan I	0.16	0.5
		Endosulfan II	0.16	0.5
		Endrin	0.16	0.5
		Endrin Aldehyde	0.16	0.5
		Methoxychlor	0.16	0.5
Site and Reference Area Bass and Crayfish Tissue	Mercury, EPA 7474 (ERDC)	Mercury	1.0 ( $\mu\text{g}/\text{kg}$ ww)	2.0 ( $\mu\text{g}/\text{kg}$ ww)
Site and Reference Area Bass and Crayfish Tissue	Total Lipids, Sulfo-Phospho-Vanillin Colorimetric Method (Van Handel 1985) (ERDC)	Total Lipids	0.001%	0.002%
Bait	PCB Aroclors, EPA 8082 (ARI)	PCB Aroclors	1.06 – 2.37 ( $\mu\text{g}/\text{kg}$ ww)	4.00 ( $\mu\text{g}/\text{kg}$ ww)
Bait	Organochlorine Pesticides, EPA 8081 (ARI)	Organochlorine Pesticides	0.0928 – 0.780 ( $\mu\text{g}/\text{kg}$ ww)	1.00 – 2.00, Methoxychlor 10.0 ( $\mu\text{g}/\text{kg}$ ww)
Bait	Mercury, EPA 7471 (ARI)	Mercury	0.000420 mg/kg	0.00500 mg/kg

**Table 6.** Sampling Summary (Number of Primary and Quality Control Samples)<sup>1</sup>

Matrix	Analyses	Primary Samples	Field Duplicate Samples <sup>2</sup>	MS/MSD <sup>3</sup>	Total Number of Field Samples
Site and Reference Bass Tissue	PCB Congeners	80	8	4/4	96
	Organochlorine Pesticides	80	8	4/4	96
	Mercury	80	8	4/4	96
	Total Lipids	80	8	0	88
Site and Reference Area Crayfish Tissue	PCB Congeners	40	4	2/2	48
	Organochlorine Pesticides	40	4	2/2	48
	Mercury	40	4	2/2	48
	Total Lipids	40	4	0	44
Bait (for bass and crayfish)	PCB Aroclors	2	0	2/2	6
	Organochlorine Pesticides	2	0	2/2	6
	Mercury	2	0	2/2	6

1. Does not include laboratory quality control samples such as laboratory duplicates and control spikes. The mass required provided by the laboratory and listed in Table 10 includes sufficient mass for all field and laboratory quality control samples.

2. Field duplicate samples will be collected at a rate of 1 per 10 primary samples.

3. MS/MSD samples will be collected at a rate of 1 pair per 20 primary samples.

### 1.3.2. Measurement Performance Criteria

Performance criteria specify the acceptable levels of uncertainty in measured data that can be used to support project decisions and achieve PQOs. Performance criteria for the analytical methods are specified in the laboratory procedures and are compliant with DoD QSM 5.1 unless otherwise noted. Any data which fall outside of these criteria must be justified, and the effects on decisions must be assessed.

### 1.4. Secondary Data Evaluation

No secondary data will be collected.

### 1.5. Project Overview and Schedule

Through project planning, the project team has agreed on the purpose of the project, the environmental questions that are being asked, and the environmental decisions that must be made. Table 7 provides a summary of the project tasks to be completed and Table 8 describes the project schedule. The field schedule is partially dictated by spill operations at Bonneville Dam. The northern shoreline of Bradford Island is within the portion of the forebay designated as a Boating Restriction Zone (BRZ). During spill operations, no boat traffic is permitted within this portions of the site. Thus, sample collection in the BRZ is limited to the months of September to April.

**Table 7.** Project Tasks

Plan, Prepare WP-QAPP & Obtain Laboratory Quote
<ul style="list-style-type: none"> <li>• Prepare and finalize WP-QAPP; obtain laboratory quotes.</li> </ul>
Sampling Tasks
<ul style="list-style-type: none"> <li>• Collect reference area bass and crayfish</li> <li>• Collect Site bass and crayfish</li> <li>• Tag bass for acoustic telemetry</li> </ul>
Analytical Tasks
<ul style="list-style-type: none"> <li>• Chemical analysis of bass and crayfish tissue</li> <li>• Data collection and analysis of acoustic telemetry</li> </ul>
Quality Control Tasks
<ul style="list-style-type: none"> <li>• Chemical analytical methods QC will comply with DoD QSM or laboratory SOPs as applicable.</li> </ul>
Secondary Data
<ul style="list-style-type: none"> <li>• No secondary data will be collected.</li> </ul>
Data Management Tasks
<ul style="list-style-type: none"> <li>• Project Chemists will review and store analytical chemistry data.</li> <li>• USGS will review and store acoustic telemetry data.</li> </ul>
Documentation and Records
<ul style="list-style-type: none"> <li>• Field notes will be recorded in a field notebook or on field log sampling sheets, then scanned and electronically stored.</li> <li>• Field notes will contain the following: date and time of sample collection, weather conditions, sample identification number, type of sample, any procedural steps taken that deviate from those outlined in this WP-QAPP.</li> <li>• Laboratory analytical results will be stored.</li> </ul>
Data Validation and Data Packages
<ul style="list-style-type: none"> <li>• 100% of chemistry data packages will be validated through Stage 2A by the Project Chemists. All data packages will be delivered in sufficient detail to support the data validation.</li> </ul>
Data Review Tasks
<ul style="list-style-type: none"> <li>• The laboratory performing chemical analyses of samples will verify that all data are complete for samples received.</li> <li>• Chemical data will be validated using the principles of the USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (2008).</li> <li>• Validated data will be reviewed.</li> <li>• Data usability will be assessed.</li> <li>• Measurement performance criteria set in WP-QAPP checked.</li> <li>• Data limitations will be determined. Data compared to PQOs.</li> </ul>

**Table 8.** Estimated Project Schedule

Task #:Description	Start	Finish
<b>Task #1: Plan, Prepare WP-QAPP and Obtain Laboratory Quotes</b>		
Prepare Draft WP-QAPP	1 May 2020	30 June 2020
TAG Review	1 July 2020	30 July 2020
Finalize WP-QAPP	1 August 2020	15 August 2020
Obtain laboratory quote, finalize, and receive sample containers	1 June 2020	15 August 2020
Purchase Field Equipment	1 July 2020	30 July 2020
<b>Task #2: Field Work</b>		
Area outside BRZ	24 August 2020	31 August 2020
Area within BRZ (BRZ permit required)	1 September 2020	30 September 2020

Task #:Description	Start	Finish
<b>Task #3: Review Data and Prepare Report</b>		
Receive Data Deliverable from Lab	1 November 2020	1 November 2020
Data Validation	1 November 2020	30 December 2020
Receive Data from USGS for Acoustic Telemetry	31 December 2020	30 April 2021
Draft and Final Data Reports	1 January 2021	30 June 2021

## 2. DATA GENERATION AND ACQUISITION

### 2.1. Sampling Tasks

Sample identification and field sampling will be performed following the protocols described in this section. Contingencies may arise during activities that will require modification of the general procedures outlined herein. Such modifications will be at the discretion of the field lead after consultation with the study technical lead and PM, the boat captain, and sampling team in the field. All modifications will be recorded and document in the field or data report, as appropriate.

#### 2.1.1. Sampling Process Design and Rationale

The USGS will be leading the sample collection effort for both tissue collection for chemical analysis as well as capture and tagging of smallmouth bass. Appendix B provides the implementation plan for those field sampling efforts. USACE staff will be on site to support the USGS, particularly for processing of tissue for shipment to the laboratory for chemical analysis.

##### Reference Tissue

For smallmouth bass, both Site and reference bass will be collected in the immediate area of Bonneville Dam. The intent is to increase potential catch numbers in the area closest to Bradford Island. Based on previous sampling conducted in 2011 and earlier, it is possible that two distinct populations of bass are present in the Bonneville dam area; those exhibiting contamination likely obtained from Bradford Island and those not/less impacted by contamination at Bradford Island. See section 2.1.2 and Appendix C for additional information.

Given the approach to collect reference tissue for bass in the same general vicinity as Site fish impacted by Bradford Island, the results will need to be evaluated both statistically, visually, and against existing datasets representative of reference or background concentrations. ProUCL will be used to visually represent the data and statistically evaluate the dataset for outliers. Any outliers are assumed to be representative of impacts from Bradford Island contamination. Based on previous collection efforts, it is possible that bass of elevated concentration will be captured near Goose Island. While areas of collection are not necessarily indicative of the source of contamination for bass, fish captured from Goose Island will initially be evaluated separately from the Bradford Island bass. If telemetry data indicate frequent movements from Bradford Island to the Goose Island area or if other media indicate there are no contamination sources from the Goose Island area – the interactions between the two areas will be evaluated. Previous datasets associated with Bradford Island fish collection and other nearby fish

collection studies in the Columbia River will also be referenced to identify concentrations that appropriately represent a reference concentration. Bass collected as part of this field effort will be statistically compared to those reference concentrations.

Crayfish tissue for purposes of establishing reference concentrations will be collected upriver of Stevenson, Washington. This is the same general location targeted in previous sampling efforts for reference tissue. However, sampling stations will be located immediately upstream of the previous reference collection locations were identified in an attempt to avoid potential contamination from industrial facilities located within Stevenson, Washington, and within Cascade Locks, Oregon. See section 2.1.2 and Appendix C for additional information.

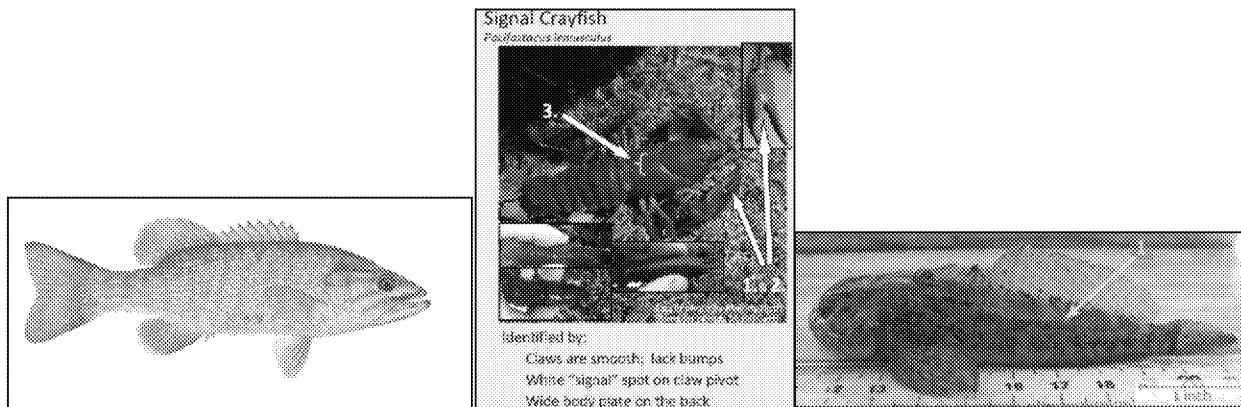
### 2.1.2. Sample Collection Procedures

Sample collection will be led by the USGS. An Implementation Plan describing collection procedures for both smallmouth bass and crayfish is included in Appendix B.

Target species for capture are the smallmouth bass and signal crayfish. Sexually mature bass are typically represented by a total length ranging from 150 to 400 mm. Bass of this size will be targeted for chemical sampling and telemetry. However, bass out of this range may also be retained, especially if abundance is low. An effort will be made to tag bass proportionally throughout the size range. For crayfish, any size retainable in the traps are considered suitable for chemical analysis.

Any sculpin species (*Cottis* spp) that are incidentally captured via angling or traps will be retained and archived for potential future analysis. Consistent with RI sampling, sculpin 75 to 150 mm in size will be targeted, but individuals outside this range may also be retained if abundance is low. Any sculpin, no retained will be returned to the river with minimum handling.

Non-target species captured via angling or trap will be document, identified as juvenile or adult, then released with minimal handling.



**Figure 2.** Smallmouth bass (left), signal crayfish (center), and sculpin (right) (photo source: <https://www.dfw.state.or.us/>)

### Bradford Island and Reference Sampling Locations

Target collection locations for angling are along the northern shoreline of Bradford Island, in the vicinity of Goose Island, and in the forebay immediately adjacent and upstream of those areas. Maps in Appendix C indicate the areas of focus for angling efforts and the targeted number of smallmouth bass in each of those areas. However, fishing effort may be adjusted based on the locations of fish and catch success in the event that targeted numbers cannot be achieved. Information from historic collection efforts will be used to help guide staff to where successful collection previously occurred.

For crayfish, traps will be placed at the approximate locations indicated in Appendix C. The GPS coordinates for the centroids of these trap locations are presented in Table 9. These locations are approximate and may need to adjust based on field conditions and catch success.

**Table 9.** Approximate GPS coordinates for crayfish traps at Reference and Site

Reference Area			Site		
Sample Number	Latitude	Longitude	Sample Number	Latitude	Longitude
<b>1</b>	45°41'57.691"N	121°52'10.749"W	<b>21</b>	45°38'41.049"N	121°55'36.609"W
<b>2</b>	45°41'55.333"N	121°52'11.945"W	<b>22</b>	45°38'39.329"N	121°55'35.072"W
<b>3</b>	45°41'57.142"N	121°52'13.866"W	<b>23</b>	45°38'37.553"N	121°55'39.429"W
<b>4</b>	45°41'56.681"N	121°52'16.79"W	<b>24</b>	45°38'36.436"N	121°55'43.101"W
<b>5</b>	45°41'54.791"N	121°52'17.089"W	<b>25</b>	45°38'38.124"N	121°55'44.699"W
<b>6</b>	45°41'55.595"N	121°52'19.696"W	<b>26</b>	45°38'25.349"N	121°55'58.601"W
<b>7</b>	45°41'54.705"N	121°52'22.548"W	<b>27</b>	45°38'20.727"N	121°56'9.629"W
<b>8</b>	45°41'54.05"N	121°52'20.421"W	<b>28</b>	45°38'16.742"N	121°56'26.146"W
<b>9</b>	45°41'53.347"N	121°52'22.969"W	<b>29</b>	45°38'26.972"N	121°56'16.019"W
<b>10</b>	45°41'51.207"N	121°52'24.276"W	<b>30</b>	45°38'27.908"N	121°56'9.872"W
<b>11</b>	45°41'50.084"N	121°52'26.347"W	<b>31</b>	45°38'32.103"N	121°56'4.296"W
<b>12</b>	45°41'50.726"N	121°52'29.989"W	<b>32</b>	45°38'33.358"N	121°56'5.247"W
<b>13</b>	45°41'49.26"N	121°52'29.128"W	<b>33</b>	45°38'34.748"N	121°56'6.133"W
<b>14</b>	45°41'49.045"N	121°52'32.752"W	<b>34</b>	45°38'34.851"N	121°56'8.093"W
<b>15</b>	45°41'47.382"N	121°52'31.406"W	<b>35</b>	45°38'35.513"N	121°56'10.034"W
<b>16</b>	45°41'48.057"N	121°52'33.401"W	<b>36</b>	45°38'34.552"N	121°56'12.362"W
<b>17</b>	45°41'46.309"N	121°52'33.802"W	<b>37</b>	45°38'34.974"N	121°56'14.664"W
<b>18</b>	45°41'45.754"N	121°52'35.738"W	<b>38</b>	45°38'33.991"N	121°56'16.9"W
<b>19</b>	45°41'44.518"N	121°52'35.368"W	<b>39</b>	45°38'34.906"N	121°56'18.8"W
<b>20</b>	45°41'43.236"N	121°52'37.331"W	<b>40</b>	45°38'34.147"N	121°56'20.295"W

### Smallmouth Bass Stomach Contents

Immediately following capture and euthanasia of bass, stomach content of each individual bass will be obtained via gastric lavage. Stomach content from each fish will be individually collected in a metal strainer then placed in a labeled sample jar. Samples will be archived for potential future analysis.

### Bait

Before use, a representative samples of bait (worms, canned cat food, tuna, frozen shad, etc.) used in the crayfish traps and for bass collection will be analyzed for PCB Aroclors, organochlorine pesticides, and total mercury. The bait will not be used if detectable levels of PCB Aroclors are observed. For canned bait, every effort will be made to use cans with a single lot number. The canned bait will be punctured with a designated stainless steel knife and placed within each trap immediately before deployment.

### Chemical Analysis

For chemical analysis, smallmouth bass will be analyzed as individual samples, and no compositing is anticipated. Crayfish will be composited to achieve a minimum biomass of 80 g needed for all chemical analyses, approximately 3 crayfish. All specimen will be wrapped in aluminum foil, double bagged, labeled, and placed on dry ice for shipment to the laboratory. The goal is to collect 80 smallmouth bass for chemical analysis. Statistical analysis to support the target collection numbers is provided in Appendix D. The target numbers for crayfish in the Site and reference area are 20 separate composites (comprised of 3 crayfish per composite) for each area. The targeted numbers for sculpin in the Site and reference area are 20 individual specimens. Depending upon sculpin size, numbers collected, and chemical analytes, compositing may be required.

#### **2.1.3. Sample Naming Convention**

Bass, crayfish, and sculpin will be given an identification for each sample (or composite). The naming convention will include initials for the specimen type (SB=smallmouth bass; CF=crayfish; SC=sculpin), a number indicating the boat crew (1, 2, etc.), and a 3-digit sample/composite number (001, 002, 003, etc.). Field duplicate samples will end in “FD”, and matrix spike and matrix spike duplicate samples will end in “MS” and “MSD”, respectively.

Examples:

SB1001 (primary sample)

SB1001FD (field duplicate associated with primary sample #1)

SB1001MS (matrix spike associated with primary sample #1)

SB1001MSD (matrix spike duplicate associated with primary sample #1)

**Table 10.** Methods, Sample Containers, Volumes, Preservation, and Holding Times for Crayfish and Smallmouth Bass Tissue Samples

Analytes	Analytical Method	Container Type/Quantity	Preservation	Minimum Mass per Sample <sup>1</sup> (g)	Holding Time (ERDC)
PCB congeners	EPA 8082 Modified (ERDC) with subset EPA 1668C (ERDC commercial subcontractor)	Aluminum foil inside Ziploc bag	Thawed: 4 °C ± 2 °C Frozen: -20 °C	40	Thawed: 14 days Frozen: 1 year
Organochlorine Pesticides	EPA 8081 (ERDC)	Aluminum foil inside Ziploc bag	Thawed: 4 °C ± 2 °C Frozen: -20 °C	30	Thawed: 14 days Frozen: 1 year
Mercury	EPA 7474 (ERDC)	Aluminum foil inside Ziploc bag	Thawed: 4 °C ± 2 °C Frozen: -20 °C	6	Thawed: 14 days Frozen: 1 year
Total Lipids	Sulfo-Phospho-Vanillin Colorimetric Method (Van Handel 1985) (ERDC)	Aluminum foil inside Ziploc bag	Thawed: 4 °C ± 2 °C Frozen: -20 °C	3	Thawed: 14 days Frozen: 1 year

1. Tissue mass listed includes all laboratory and field quality control samples, such as blank, duplicate, LCS/LCSD, MS/MSD, and potential re-extraction.

#### **2.1.4. Decontamination Procedures**

All potential sources of contamination in the field will be identified by the field lead, and appropriate steps will be taken to minimize or eliminate contamination. Ice chests will be scrubbed clean with Alconox® or Liquinox® detergent and rinsed with distilled water after use to prevent potential cross contamination. To avoid contamination from melting ice, the dry ice will be separated from samples by placing all samples in large plastic bags. Prior to each use, sampling equipment will be cleaned with Alconox® or Liquinox® phosphate-free detergent and rinsed with deionized water.

#### **2.1.5. Field Equipment Calibration, Maintenance, Testing and Inspection Procedures**

No field equipment requires calibration, maintenance, testing and inspection. If any sampling procedures are changed to include use of field equipment, that information will be included in the field notes.

#### **2.1.6. Supply Inspection and Acceptance Procedures**

Inspection and acceptance of supplies and consumables will be conducted prior to field work in order to ensure that the appropriate type and quantity of supplies are brought to the field. Any supplies and consumables used in the sample collection process or instrument calibration will be inspected.

#### **2.1.7. Field Documentation Procedures**

Field documentation provides a permanent record of field activities and can be used, if necessary, to trace possible introduction of field sampling error.

Field notes will be maintained either in a bound logbook, or on field sampling log sheets. After fieldwork is complete, electronic copies will be made of the field notes and the electronic copies will be stored in the project files. All information pertinent to the sampling effort will be recorded in the field notes. Documentation in the field notes will be at a level of detail sufficient to explain and reconstruct field activities without relying on recollection by the field team members. The Field Sampling Lead has overall responsibility for accuracy and completeness of field notes. Each page/form will be consecutively numbered. All entries will be made in indelible ink and corrections will consist of lined-out deletions. As a minimum, the applicable items for the entry into the field notes are listed below.

#### General Information

- Date
- Time
- Weather conditions
- Names of personnel present

#### Sampling Information

- Location of sample
- Type of sample
- Sample identification number
- Associated QC samples
- Any unusual observations

#### **2.1.8. Sample Delivery**

Sample delivery procedures include packaging, labeling, and shipment to the laboratory. These procedures are designed (1) to preserve sample quality so that analyses will yield results representative of site conditions, (2) to protect and inform sample handlers, including shippers and laboratory personnel, and (3) to provide a paper trail to allow cross referencing of sample collection locations with analytical results. See appendix H for dry ice sampling packing and shipping methods.

All samples will be shipped on dry ice. Dry ice will be supplied by the following vendor:

OXARC® Inc.  
19310 NE San Rafael St, Portland, OR 97230  
(503) 618-1625

Samples will be shipped from the nearest FedEx facility that accepts packages containing dry ice:

FedEx Ship Center  
5159 NE Cornfoot Rd  
Portland, OR 97218

All samples will be labeled with its own sample identification number and all other applicable information. Samples will be shipped with dry ice overnight via FedEx to the laboratory. To avoid

potential shipping delays, shipments for Thursday and Friday will be avoided and held in a freezer or on dry ice till the following Monday for shipment. The shipping address for the laboratory is:

USACE ERDC EL EPC B3299  
3909 Halls Ferry Road  
Vicksburg, MS 39180

### **2.1.9. Sample Custody**

A sample is in “custody” if it is in the actual physical possession of authorized personnel or in a secure area that is restricted to authorized personnel. Custody procedures ensure data authenticity and defensibility. Chain of custody (CoC) forms will accompany sample containers during transit to the laboratory and be checked by the laboratory upon receipt.

## **2.2. Analytical Tasks**

Once samples have been collected, they will be analyzed by the laboratories. The Project Chemists will validate the analytical data.

The following sections address all components of project-specific analytical measurements; method and laboratory-specific QC measurements; acceptance criteria; corrective actions; calibration procedures; equipment and supply maintenance; testing; and inspection requirements. Modifications to approved procedures, alternate procedures, or additional procedures are to be pre-approved in writing by the Project Chemist.

### **2.2.1. Analytical Methods**

See Table 5 for analytical methods that will be used for analysis of tissue samples.

### **2.2.2. Analytical Instrument Calibration Procedures**

Calibration procedures and instrumentation shall be consistent with the requirements of the methods.

### **2.2.3. Analytical Instrument and Equipment Maintenance, Testing, and Inspection Procedures**

Maintenance, testing, and inspection procedures shall be consistent with the requirements of the methods.

## **2.3. Quality Control Samples**

Quality control (QC) samples are collected and analyzed for the purpose of assessing the quality of the sampling and analysis performed by the field personnel and the primary laboratory. The Project Chemist will coordinate selection of QC samples prior to each sampling event.

### **2.3.1. Field Quality Control Samples**

#### *2.3.1.1. Field Duplicates*

Field duplicate samples will be collected at a rate of 1 per 10 primary samples. Field duplicate samples for tissue will be evaluated at 50% relative percent difference.

#### *2.3.1.2. Trip Blanks*

No trip blanks will be collected for this sampling event as they are not necessary for the selected methods.

#### *2.3.1.3. Equipment Rinse Blanks*

No equipment rinse blanks will be collected since there is no reusable sampling equipment such as scoops or containers utilized in bass and crayfish collection.

### **2.3.2. Analytical Method Quality Control Samples**

Method QC includes the analyses and activities required to ensure that the analytical system is in control prior to and during an analytical run. Method QC requirements for this project include the following: method blanks, surrogate spikes, matrix spikes/matrix spike duplicate pairs, and laboratory control samples.

#### *2.3.2.1. Method Blanks*

Method blanks are composed of organic/analyte-free water processed simultaneously with and under the same conditions as samples through all steps of the analytical procedure. Method blanks verify that the measurement system is free of contamination.

#### *2.3.2.2. Laboratory Control Samples (LCS)*

Laboratory control sample (LCSS) are composed of organic/analyte-free water spiked with verified amounts of analytes. They are used to evaluate accuracy and precision, including to establish intra-laboratory or analyst-specific precision or to assess the performance of all or a portion of the measurement system. The LCS is analyzed in the same manner as a sample, including preservation. Laboratory acceptance criteria will be used for evaluation of the results.

#### *2.3.2.3. Matrix Spike and Matrix Spike Duplicate (MS/MSD)*

MS/MSD samples are used to evaluate matrix interference and to determine laboratory accuracy and precision. For methods that require MS/MSDs, MS/MSD samples will be collected at a rate of 1 pair per 20 primary samples. Laboratory acceptance criteria will be used for evaluation of the results.

#### *2.3.2.4. Surrogates*

Surrogates are substances with properties that mimic the analyte of interest. A surrogate is unlikely to be found in environment samples, and is therefore added to assess accuracy of the results. Laboratory acceptance criteria will be used for evaluation of the results.

### **3. ASSESSMENT AND OVERSIGHT**

Laboratory and field operations have established policies and procedures, and they designate authorities for implementing corrective action when nonconforming work or departures from the policies and procedures in the quality system or technical operations have been identified. Both field and laboratory operations shall follow all corrective action requirements in methods and SOPs.

The following laboratory documentation is to be made accessible to the USACE Project Chemist. Corrective actions may be required, at the request of USACE, for the following conditions:

- Laboratory Procedures
- QC data outside the defined acceptance windows for precision or accuracy
- Blanks or LCS's that contain contaminants above acceptable levels stated in the Project Quality Objectives
- Undesirable trends in spike or surrogate recoveries or RPD between spiked duplicates
- Unusual changes in method detection limits
- Deficiencies identified during internal or external audits or from the results of performance

The following corrective actions should be taken for common problems:

**Incoming Samples** - Problems noted during sample receipt are to be documented. The USACE Project Chemist is to be notified for problem resolution.

**Sample Holding Times** - If a maximum holding time is or may be exceeded by the laboratory, the USACE Project Chemist must be notified for problem resolution. The USACE Project Chemists may require re-sampling for the requested parameters.

**Instrument Calibration** - Sample analysis may not proceed until initial calibrations meet method criteria. Calibrations must meet method time requirements or recalibration must be performed. Continuing calibrations that do not meet accuracy criteria should result in a review of the calibration, rerun of the appropriate calibration standards, and reanalysis of samples affected back to the previous acceptable calibration check.

**Limit of Quantitation (LOQ)** - Appropriate sample clean-up procedures must be employed to attempt to achieve the practical quantitation limits as stated in the method. If difficulties arise in achieving these limits due to a particular sample matrix, the laboratory should notify the USACE Project Chemists of the problem for resolution. Dilutions are to be documented in the case narrative along with the revised practical quantitation limits for those analytes directly affected. Analytes detected above the method detection limits (MDLs) but below the practical limit(s) of quantitation are to be reported as estimated values and qualified "J".

Method Quality Control - Results related to method QC, including blank contamination, duplicate measurement reproducibility, MS/MSD recoveries, surrogate recoveries, LCS recoveries, and other method-specified QC measures are to meet the laboratory's SOPs and PQOs specified in this plan. Otherwise, the affected samples may be reanalyzed and/or re-extracted and reanalyzed within method-required holding times to verify the presence or absence of matrix effects. In order to confirm matrix effects, QC results must observe the same direction and magnitude (ten times) bias. The USACE Project Chemist should be notified as soon as possible to discuss appropriate corrective action.

Calculation Errors - Reports must be reissued if calculation and/or reporting errors are noted with any given data package. The case narrative is to state the reason(s) for re-issuance of a report.

## **4. DATA MANAGEMENT AND DOCUMENTATION**

### **4.1. WP-QAPP**

An electronic copy of the WP-QAPP (including appendices) will be stored in USACE project files and provided to the Technical Advisory Group.

### **4.2. Final Report**

Upon completion of the sampling event and receipt/review of the validated data, USACE will prepare a final report. The report may be issued separately, or as an appendix to a future report that addresses source control. The report will include the following:

- Narrative and timeline of project activities
- Summary of sampling, chemical testing, and any deviations from the QAPP
- Analytical data summary and discussion
- Figures, tables, and appendices

The appendices will include field logs, laboratory analytical reports, data validation reports, and data summary tables with associated validation flags.

### **4.3. Laboratory Documentation (Data Package Deliverables)**

#### **4.3.1. Data Package Deliverables**

The analytical data packages from the laboratories will be provided to the Project Chemist in sufficient detail for the required level of data validation. The analytical data packages will be validated to Stage 2a by the Project Chemist for 100% of all samples analyzed by the laboratory.

#### **4.3.2. Electronic Data Reporting Formats**

Laboratory data will be accepted as a report in PDF format. An Excel electronic deliverable will also be provided.

## **5. DATA REVIEW, VERIFICATION, AND VALIDATION**

Data review is the process by which data are examined and evaluated to varying levels of detail and specificity by a variety of personnel who have different responsibilities within the data management process. It includes verification, validation, and usability assessment. This process ensures the review activities produce scientifically sound data that are of known and documented quality and meet PQOs used in making environmental decisions.

### **5.1. Review of Data**

All laboratory data packages will include raw data necessary for full validation. Analytical data packages will be validated to Stage 2a by the Project Chemist for 100% of all samples analyzed by the contracted laboratory.

Three distinct evaluative steps will be used to ensure that project-specific data quality needs are met:

- Data Verification (review for completeness) – Confirmation by examination and provision of objective evidence that the specified requirements (sampling and analytical) have been completed.
- Data Validation – Confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled. Validation is a sampling and analytical process that includes evaluating compliance with method, procedure, or contract requirements and extends to evaluating against criteria based on the quality objectives developed in the QAPP (e.g., the QAPP measurement performance criteria). The purpose of validation is to assess the performance of the sampling and analysis processes to determine the quality of specified data. Data Validation Reports will be generated for each sampling event.
- Data Usability Assessment – Determination of the adequacy of data, based on the results of validation and verification, and professional judgment by the Project Chemist, for the decisions being made. The usability step involves assessing whether the process execution and resulting data meet project quality objectives documented in the QAPP.

Data review will be based on laboratory-specific SOPs conforming to the method and applying the principles of the Department of Defense Data Validation Guidelines (DoD, 2019b, 2020a, 2020b), and where applicable and not in conflict, the National Functional Guidelines for Superfund Data Review (USEPA, 2016, 2017a, 2017b). If significant deviations arise as a result of initial verification and validation, the level of review will be elevated in order to determine the source and impact of deviations.

### **5.2. Data Verification and Validation Stages**

Data validation and verification stages described below are in accordance with the Department of Defense Data Validation Guidelines (DoD, 2019b) and Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use (EPA, 2009).

### **5.2.1. Stage 1**

Verification and validation begins with Stage 1 checks of the laboratory analytical data package consisting of compliance of sample receipt conditions, sample characteristics (e.g., percent moisture), and analytical results (with associated information). The following minimum baseline checks (as relevant) shall be performed on the laboratory analytical data package received for a Stage 1 validation label:

- (1) Documentation identifies the laboratory receiving and conducting analyses, and includes documentation for all samples submitted by the project or requested for analyses.
- (2) Requested analytical methods were performed and the analysis dates are present.
- (3) Requested target analyte results are reported along with the original laboratory data qualifiers and data qualifier definitions for each reported result (and the uncertainty of each result and clear indication of the type of uncertainty reported if required).
- (4) Requested target analyte result units are reported.
- (5) Requested reporting limits for all samples are present and results at and below the project-specific reporting limits are clearly identified (including sample detection limits if required).
- (6) Sampling dates (including times if needed), date and time of laboratory receipt of samples, and sample conditions upon receipt at the laboratory (including preservation, pH and temperature) are documented.
- (7) Sample results are evaluated by comparing sample conditions upon receipt at the laboratory (e.g., preservation checks) and sample characteristics (e.g., percent moisture) to the requirements and guidelines present in national or regional data validation documents, analytical method(s) or contract.

### **5.2.2. Stage 2A**

Stage 2A validation builds on the validation conducted in Stage 1. Stage 2A validation of the laboratory analytical data package consists of the Stage 1 validation plus the verification and validation checks for the compliance of sample-related QC. The following additional minimum baseline checks (as relevant) shall be performed on the laboratory analytical data package received for a Stage 2A Validation label:

- (8) Requested methods (handling, preparation, cleanup, and analytical) are performed.
- (9) Method dates (including dates, times and duration of analysis for radiation counting measurements and other methods, if needed) for handling (e.g., Toxicity Characteristic Leaching Procedure), preparation, cleanup and analysis are present, as appropriate.
- (10) Sample-related QC data and QC acceptance criteria (e.g., method blanks, surrogate recoveries, deuterated monitoring compounds (DMC) recoveries, laboratory control sample (LCS) recoveries, duplicate analyses, matrix spike and matrix spike duplicate recoveries) are provided and linked to the reported field samples (including the field quality control samples such as trip and equipment blanks).

- (11) Requested spike analytes or compounds (e.g., surrogate, DMCs, LCS spikes) have been added, as appropriate.
- (12) Sample holding times (from sampling date to preparation and preparation to analysis) are evaluated.
- (13) Frequency of QC samples is checked for appropriateness (e.g., one LCS per twenty samples in a preparation batch).
- (14) Sample results are evaluated by comparing holding times and sample-related QC data to the requirements and guidelines present in national or regional data validation documents, analytical method(s) or contract.

### 5.2.3. Stage 2B

Stage 2B validation builds on the validation conducted in Stage 2A. Stage 2B validation of the laboratory analytical data package consists of the Stage 2A validation plus the verification and validation checks for the compliance of instrument-related QC. The following additional minimum baseline checks (as relevant) shall be performed on the laboratory analytical data package received for a Stage 2B Validation label:

- (15) Initial calibration data (e.g., initial calibration standards, initial calibration verification [ICV] standards, initial calibration blanks [ICBs]) are provided for all requested analytes and linked to field samples reported. For each initial calibration, the calibration type used is present along with the initial calibration equation used including any weighting factor(s) applied and the associated correlation coefficients, as appropriate. Recalculations of the standard concentrations using the initial calibration curve are present, along with their associated percent recoveries, as appropriate (e.g., if required by the project, method, or contract). For the ICV standard, the associated percent recovery (or percent difference, as appropriate) is present.
- (16) Appropriate number and concentration of initial calibration standards are present.
- (17) Continuing calibration data (e.g., continuing calibration verification [CCV] standards and continuing calibration blanks [CCBs]) are provided for all requested analytes and linked to field samples reported, as appropriate. For the CCV standard(s), the associated percent recoveries (or percent differences, as appropriate) are present.
- (18) Reported samples are bracketed by CCV standards and CCBs standards as appropriate.
- (19) Method specific instrument performance checks are present as appropriate (e.g., tunes for mass spectrometry methods).
- (20) Frequency of instrument QC samples is checked for appropriateness (e.g., gas chromatography-mass spectroscopy [GC-MS] tunes have been run every 12 hours).
- (21) Sample results are evaluated by comparing instrument-related QC data to the requirements and guidelines present in national or regional data validation documents, analytical method(s) or contract.

#### **5.2.4. Stage 3**

Stage 3 validation builds on the validation conducted in Stage 2B. Stage 3 validation of the laboratory analytical data package consists of the Stage 2B validation plus the recalculation of instrument and sample results from the laboratory instrument responses, and comparison of recalculated results to laboratory reported results. The following additional minimum baseline checks (as relevant) shall be performed on the laboratory analytical data package received for a Stage 3 Validation label:

- (22) Instrument response data (e.g., GC peak areas) are reported for requested analytes, surrogates, internal standards, and DMCs for all requested field samples, matrix spikes, matrix spike duplicates, LCS, and method blanks as well as calibration data and instrument QC checks (e.g., tunes).
- (23) Reported target analyte instrument responses are associated with appropriate internal standard analyte(s) for each (or selected) analyte(s) (for methods using internal standard for calibration).
- (24) Fit and appropriateness of the initial calibration curve used or required (e.g., mean calibration factor, regression analysis [linear or non-linear, with or without weighting factors, with or without forcing]) is checked with recalculation of the initial calibration curve for each (or selected) analyte(s) from the instrument response.
- (25) Comparison of instrument response to the minimum response requirements for each (or selected) analyte(s).
- (26) Recalculation of each (or selected) opening and closing CCV (and CCB) response from the peak data reported for each (or selected) analyte(s) from the instrument response, as appropriate.
- (27) Compliance check of recalculated opening and/or closing CCV (and CCB) response to recalculated initial calibration response for each (or selected) analyte(s).
- (28) Recalculation of percent ratios for each (or selected) tune from the instrument response, as appropriate.
- (29) Compliance check of recalculated percent ratio for each (or selected) tune from the instrument response.
- (30) Recalculation of each (or selected) instrument performance check (e.g., instrument blanks,) from the instrument response.
- (31) Recalculation and compliance check of retention time windows (for chromatographic methods) for each (or selected) analyte(s) from the laboratory reported retention times.
- (32) Recalculation of reported results for each reported (or selected) target analyte(s) from the instrument response.
- (33) Recalculation of each (or selected) reported spike recovery (surrogate recoveries, DMC recoveries, LCS recoveries, duplicate analyses, matrix spike and matrix spike duplicate recoveries) from the instrument response.

(34) Each (or selected) sample result(s) and spike recovery(ies) are evaluated by comparing the recalculated numbers to the laboratory reported numbers according to the requirements and guidelines present in national or regional data validation documents, analytical method(s) or contract.

Note: Selection of analytes, spikes, and performance evaluation checks for the Stage 3 validation checks for a laboratory analytical data package being verified and validated generally will depend on many factors including (but not limited to) the type of verification and validation being performed (manual or electronic), requirements and guidelines present in national or regional data validation documents, analytical method(s) or contract, the number of laboratories reporting the data, the number and type of analytical methods reported, the number of analytes reported in each method, and the number of detected analytes.

#### **5.2.5. Stage 4**

Stage 4 validation builds on the validation conducted in Stage 3. Stage 4 validation of the laboratory analytical data package consists of the Stage 3 validation plus the evaluation of instrument outputs. The following additional minimum baseline checks (as relevant) shall be performed on the laboratory analytical data package received for a Stage 4 Validation label:

(35) All required instrument outputs (e.g., chromatograms, mass spectra) for evaluating sample and instrument performance are present.

(36) Sample results are evaluated by checking each (or selected) instrument output (e.g., chromatograms, mass spectra) for correct identification and quantitation of analytes (e.g., peak integrations, use of appropriate internal standards for quantitation, elution order of analytes, and interferences).

(37) Each (or selected) instrument's output(s) is evaluated for confirmation of non-detected or tentatively identified analytes.

Selection of instrument outputs for the Stage 4 validation checks for a laboratory analytical data package being verified and validated generally will depend on many factors including, but not limited to, the type of verification and validation being performed (electronic or manual), requirements and guidelines present in national or regional data validation documents, analytical method(s) or contract, the number of laboratories reporting the data, the number and type of analytical methods reported, the number of analytes reported in each method, and the number of detected analytes.

### **5.3. Data Verification and Validation Stages**

A data validation report will be generated by the USACE Chemist that encompasses the results of the manual review of private lab data. The data validation report will be an appendix to the Final Report. Professional judgment shall be used when deciding if qualification of data is applicable. When professional judgment is applied, the rationale shall be provided. Tables of qualified data and the reasons for qualification will also be included in the data validation report.

Qualifiers will be added to data during the review as necessary. Qualifiers applied to the data as a result of the review are as follows:

- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit. The data are usable for decision-making purposes.
- UJ Indicates the compound or analyte was analyzed for but not detected. Due to a quality control deficiency identified during data validation, the value reported may not accurately reflect the sample quantitation limit. The associated value is considered estimated, but the data are generally usable for decision-making purposes.
- J Indicates the compound or analyte was analyzed for and detected. The associated value is estimated due to a quality control deficiency identified during data validation. False positives or false negatives are unlikely to have been reported and the data are generally usable for decision-making purposes.
- J+ Data are qualified as estimated with a high bias. False positives are likely to occur but the data are generally usable for decision-making purposes.
- J- Data are qualified as estimated with a low bias. False negatives are likely to occur but the data are generally usable for decision-making purposes.
- X The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.
- R The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified. Rejection of the data should be decided by the project team (which should include a project chemist).

Note: It is possible that J-qualified data are not suitable for some purposes. For example, a J-qualified concentration with a low bias that is just below a screening value may not be usable to determine whether the analyte concentration is above or below the screening value. The effect of the use of qualified data on the decision-making process must be evaluated as part of the “reconciliation with user requirements” process.

## 5.4. Usability Assessment

The Project Chemist will evaluate overall precision, accuracy, completeness, representativeness, comparability, and sensitivity of the sampling data; including an assessment of the overall usability of the data and describing any limitations on its use. The Project Chemist will summarize any audit information, indicating corrective actions taken. This information will be part of the data validation report, which is an appendix to the Final Report.

#### **5.4.1. Precision**

Precision is defined as the degree of agreement between or among independent, similar, or repeated measures. Duplicate pairs such as MS/MSD, LCS/LCSD, laboratory duplicate, and field duplicate samples are evaluated as RPD. The relative percent difference (RPD) for these analyses is calculated as follows:

$$RPD = \frac{|S_1 - S_2|}{S_{avg}} \times 100\%$$

Where  $S_1$  and  $S_2$  = the observed concentration of analyte in the sample and its duplicate, and

$S_{avg}$  = the average of observed analyte concentration in the samples and its duplicate.

#### **5.4.2. Accuracy**

Accuracy is the amount of agreement between a measured value and the true value. Accuracy, expressed as %Recovery (%R), is assessed for each method, analyte, and matrix, by comparing MS, MSD, LCS, LCSD, and surrogate recoveries to the method limits.

#### **5.4.3. Representativeness**

Representativeness is a qualitative parameter that expresses the degree to which the sample data are characteristic of a population. Blank samples identify compounds that may have been introduced into the samples during preparation, or analysis. Representativeness is addressed by evaluating blank samples, sample custody, and holding times and temperatures.

#### **5.4.4. Completeness**

Analytical completeness is expressed as the percentage of measurements that were judged to be valid, i.e., not rejected, and acceptable for all intended date use.

#### **5.4.5. Sensitivity**

Sensitivity is the ability of an analytical method or instrument to discriminate between measurement responses representing different concentrations. The sensitivity of the analytical methods (i.e., method reporting limits) identified for this project are evaluated against the QAPP.

## **6. REFERENCES**

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United States Environmental Protection Agency (USEPA). 2005. Intergovernmental Data Quality Task Force Uniform Federal Policy for Quality Assurance Project Plans Guidance, Part 1: UFP-QAPP Manual. March.

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## **Appendix A: Summary of historic tissue results for bass and crayfish**

**Table 6-10a**  
**Post-Removal Forebay Area Crayfish Tissue Analytical Results**  
**PCB Aroclors, PCB Dioxin-Like Congeners, Metals, and Semivolatile Organic Compounds**  
**(Page 1 of 3)**

Area	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	Selected SLV	SLV Source
Site ID	P01-CF	P02-CF	P03-CF	P04-CF	P05-CF	P06-CF		
Sample ID	08021901CF	08021902CF	08022003CF	08021904CF	08021505CF	08021406CF		
Sample Date	2/19/2008	2/19/2008	2/20/2008	2/19/2008	2/15/2008	2/14/2008		
Percent Lipds	1.2	1.7	0.62	0.55	1.4	1.1		
<b>PCB Aroclors (µg/kg wet)</b>								
Aroclor 1016	2.40 U	2.40 U	2.40 U	2.40 U	2.40 U	2.40 U	0.570	HH
Aroclor 1221	2.60 U	2.60 U	2.60 U	2.60 U	2.60 U	2.60 U	0.570	HH
Aroclor 1232	2.30 U	2.30 U	2.30 U	2.30 U	2.30 U	2.30 U	0.570	HH
Aroclor 1242	2.20 U	2.20 U	2.20 U	2.20 U	2.20 U	2.20 U	0.570	HH
Aroclor 1248	0.510 U	0.510 U	0.510 U	0.510 U	0.510 U	0.510 U	0.570	HH
Aroclor 1254	1.80 U	1.80 U	1.80 U	1.80 U	1.80 U	19.0 U	0.570	HH
Aroclor 1260	1.90 U	1.90 U	1.90 U	8.60 U	7.10 U	17.0 U	0.570	HH
Aroclor 1262	2.50 U	2.50 U	2.50 U	2.50 U	9.80 U	10.0 U	0.570	HH
Aroclor 1268	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	0.570	HH
Total PCBs as Aroclors (NDs at MDL) <sup>1</sup>	2.60 U	2.60 U	2.60 U	8.60 U	9.80 U	19.0 U	0.570	HH
<b>PCB Dioxin-Like Congeners (µg/kg wet)</b>								
PCB 77	<b>0.00376</b>	-	-	<b>0.00654</b>	<b>0.0148</b>	<b>0.0207</b>	0.0760	HH
PCB 81	0.000239 EMPC	-	-	<b>0.000446</b>	0.000823 EMPC	<b>0.00132</b>	0.0250	HH
PCB 105	<b>0.0146</b>	-	-	<b>0.0931</b>	<b>0.0566</b>	0.0863 EMPC	0.250	HH
PCB 114	<b>0.00661</b>	-	-	<b>0.351</b>	<b>0.355</b>	<b>0.804</b>	0.250	HH
PCB 118	<b>0.206</b>	-	-	<b>3.52</b>	<b>6.34</b>	<b>14.0</b>	0.250	HH
PCB 123	<b>0.00475</b>	-	-	<b>0.247</b>	<b>0.206</b>	<b>0.460</b>	0.250	HH
PCB 126	<b>0.000800</b>	-	-	0.00351 U	<b>0.00360</b>	<b>0.00783</b>	0.0000760	HH
PCB 156	<b>0.0382 C</b>	-	-	<b>2.28 C</b>	<b>1.62 C</b>	<b>3.91 C</b>	0.250	HH
PCB 157	PCB 156 and 157 are coeluting congeners and are represented with one concentration.						0.250	HH
PCB 167	<b>0.0230</b>	-	-	<b>1.18</b>	<b>0.629</b>	<b>1.53</b>	0.250	HH
PCB 169	0.000597 U	-	-	0.00295 U	0.00180 U	0.00120 U	0.000250	HH
PCB 189	<b>0.00269</b>	-	-	<b>0.0683</b>	<b>0.0414</b>	<b>0.0821</b>	0.250	HH
Total PCBs as Congeners (KM, capped)	<b>1.44 J</b>	-	-	<b>16.8 J</b>	<b>16.9 J</b>	<b>42.6 J</b>	0.570	HH
<b>Metals (mg/kg wet)</b>								
Aluminum	94.3	157	96.6	106	149	139	--	--
Antimony	0.0210	<b>0.0160</b>	<b>0.0500</b>	<b>0.0160</b>	<b>0.0630</b>	<b>0.133</b>	--	--
Arsenic	0.610	<b>0.680</b>	<b>0.420</b>	<b>0.550</b>	<b>0.640</b>	<b>0.520</b>	0.000760	HH
Barium	72.2	75.6	68.5	62.1	84.3	80.4	--	--
Beryllium	0.00300 J	<b>0.00380 J</b>	<b>0.00310 J</b>	<b>0.00410 J</b>	<b>0.00370 J</b>	<b>0.00330 J</b>	--	--
Cadmium	0.193	<b>0.210</b>	<b>0.101</b>	0.129	0.137	0.149	0.150	Eco
Chromium	0.700	<b>0.200</b>	<b>0.300</b>	0.700	1.20	0.800	--	--
Cobalt	0.209	<b>0.241</b>	<b>0.192</b>	0.232	0.239	0.223	--	--
Copper	22.2 J	36.0 J	19.7 J	17.3 J	26.5 J	26.1 J	--	--
Lead	0.292 J	<b>0.795 J</b>	<b>0.732 J</b>	0.566 J	2.66 J	0.653 J	0.120	Eco
Mercury	0.0232	0.0218	0.0190	0.0167	0.0239	0.0251	0.0490	HH
Methyl Mercury	<b>0.0370</b>	<b>0.0250</b>	<b>0.0310</b>	<b>0.0340</b>	<b>0.0360</b>	<b>0.0350</b>	--	--
Nickel	4.83	4.48	4.31	4.72	5.34	4.68	--	--
Thallium	0.0177	<b>0.0292</b>	<b>0.0149</b>	0.0195	0.0258	0.0236	--	--
Vanadium	0.400	<b>0.600</b>	<b>0.400</b>	0.400	0.500	0.500	--	--
Zinc	23.2 J	21.0 J	19.3 J	21.6 J	22.8 J	21.6 J	--	--
<b>Semivolatile Organic Compounds (µg/kg wet)</b>								
Bis(2-ethylhexyl) Phthalate	66.0 U	-	-	66.0 U	<b>67.0 J</b>	<b>67.0 J</b>	81.9	HH
Butyl Benzyl Phthalate	7.30 U	-	-	7.30 U	7.30 U	7.30 U	310	Eco
Carbazole	9.10 U	-	-	9.10 U	9.10 U	9.10 U	-	-
Di-n-butyl Phthalate	16.0 U	-	-	180 U	16.0 U	16.0 U	626	Eco
Di-n-octyl Phthalate	11.0 U	-	-	11.0 U	11.0 U	11.0 U	626	Eco
p-cresol (4-Methylphenol)	7.70 U	-	-	7.70 U	7.70 U	7.70 U	-	-
<b>Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (µg/kg wet)</b>								
Acenaphthene	0.110 U	-	-	0.110 U	<b>0.140 J</b>	<b>0.260 J</b>	15,000	HH
Anthracene	<b>0.0850 J</b>	-	-	0.0650 U	<b>0.160 J</b>	0.0650 U	15,000	HH
Fluorene	<b>0.160 J</b>	-	-	0.150 U	<b>0.150 J</b>	<b>0.210 J</b>	15,000	HH
Phenanthrene	<b>0.470</b>	-	-	0.360 U	<b>0.620</b>	<b>0.790</b>	15,000	HH
<b>High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (µg/kg wet)</b>								
Benzo(a)anthracene	<b>0.280 J</b>	-	-	0.0660 U	<b>0.290 J</b>	0.0660 U	1.57	HH
Benzo(a)pyrene	0.0810 U	-	-	<b>0.120 J</b>	0.0810 U	0.0810 U	0.157	HH
Benzo(b)fluoranthene	0.0700 U	-	-	0.0700 U	<b>0.100 J</b>	0.0700 U	1.57	HH
Benzo(g,h,i)perylene	0.0730 U	-	-	0.0730 U	0.0730 U	0.0730 U	15.7	HH
Benzo(k)fluoranthene	0.0560 U	-	-	0.0560 U	<b>0.110 J</b>	0.0560 U	15.7	HH
Chrysene	0.0760 U	-	-	0.0760 U	<b>0.200 J</b>	0.0760 U	157	HH
Dibenz(a,h)anthracene	0.0590 U	-	-	0.0590 U	0.0590 U	0.0590 U	0.157	HH
Fluoranthene	<b>0.260 J</b>	-	-	<b>0.210 J</b>	<b>0.400 J</b>	<b>0.540</b>	19,000	Eco
Indeno(1,2,3-cd)pyrene	0.0640 U	-	-	0.0640 U	0.0640 U	0.0640 U	1.57	HH
Pyrene	<b>0.270 J</b>	-	-	<b>0.170 J</b>	<b>0.410 J</b>	<b>0.470 J</b>	1,000	Eco

**Notes:**

µg/kg = microgram per kilogram  
 mg/kg = milligram per kilogram  
 Eco = Ecological  
 HH = Human Health  
 MDL = method detection limit  
 SLV = screening level value  
 RDL = reported detection limit  
 - = Not Analyzed  
 -- = SLV for analyte not available  
 ND = Non Detect

<sup>1</sup>The crayfish Total PCBs as Aroclors is shown as the maximum MDL because all aroclors were undected in Forebay crayfish samples.

KM, capped = Kaplan-Meier-based with Efron's bias correction, capped

J = The reported value is an estimate.

U = The analyte was not detected at or above the MDL (except PCB congeners).

For PCB congeners, the analyte was not detected at or above the RDL/EMPC.

UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.

EMPC = The analyte was not positively identified; the associated

numerical value is the Estimated Maximum Potential Concentration.

**bold** = analyte detected above MDL/RDL.

= The reported concentration exceeds the selected SLV

**Table 6-10a**  
**Post-Removal Forebay Area Crayfish Tissue Analytical Results**  
**PCB Aroclors, PCB Dioxin-Like Congeners, Metals, and Semivolatile Organic Compounds**  
**(Page 2 of 3)**

Area	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	Selected SLV	SLV Source
Site ID	P07-CF	P08-CF	P13-CF	P14-CF	P15-CF	P16-CF		
Sample ID	08021407CF	08021408CF	08021413CF	08022014CF	08021915CF	08022216CF		
Sample Date	2/14/2008	2/14/2008	2/14/2008	2/20/2008	2/19/2008	2/22/2008		
Percent Lipds	0.61	0.74	0.82	0.58	0.87	1.1		
<b>PCB Aroclors (µg/kg wet)</b>								
Aroclor 1016	2.40 U	2.40 U	2.40 U	2.40 U	2.40 U	2.40 U	0.570	HH
Aroclor 1221	2.60 U	2.60 U	2.60 U	2.60 U	2.60 U	2.60 U	0.570	HH
Aroclor 1232	2.30 U	2.30 U	2.30 U	2.30 U	2.30 U	2.30 U	0.570	HH
Aroclor 1242	2.20 U	2.20 U	2.20 U	2.20 U	2.20 U	2.20 U	0.570	HH
Aroclor 1248	0.510 U	0.510 U	0.510 U	0.510 U	0.510 U	0.510 U	0.570	HH
Aroclor 1254	1.90 U	1.80 U	1.80 U	1.80 U	1.80 U	1.80 U	0.570	HH
Aroclor 1260	4.00 U	1.90 U	1.90 U	1.90 U	1.90 U	1.90 U	0.570	HH
Aroclor 1262	2.60 U	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U	0.570	HH
Aroclor 1268	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	0.570	HH
Total PCBs as Aroclors (NDs at MDL) <sup>1</sup>	4.00 U	2.60 U	2.60 U	2.60 U	2.60 U	2.60 U	0.570	HH
<b>PCB Dioxin-Like Congeners (µg/kg wet)</b>								
PCB 77	<b>0.0105</b>	<b>0.00433</b>	<b>0.00211</b>	<b>0.00174</b>	<b>0.00438</b>	<b>0.00514</b>	0.0760	HH
PCB 81	0.000361 U	0.000228 U	0.000215 U	0.000125 U	0.000273 U	0.000289 U	0.0250	HH
PCB 105	<b>0.134</b>	<b>0.0347</b>	0.00489 EMPC	0.00367 EMPC	<b>0.00746</b>	<b>0.0132</b>	0.250	HH
PCB 114	<b>0.121</b>	<b>0.0484</b>	<b>0.00370</b>	<b>0.00569</b>	<b>0.00407</b>	<b>0.00661</b>	0.250	HH
PCB 118	<b>4.40</b>	<b>0.847</b>	<b>0.0955</b>	<b>0.112</b>	<b>0.122</b>	<b>0.248</b>	0.250	HH
PCB 123	<b>0.0690</b>	<b>0.0302</b>	<b>0.00242</b>	<b>0.00581</b>	<b>0.00337</b>	<b>0.00682</b>	0.250	HH
PCB 126	0.00260 U	0.00130 U	<b>0.000306</b>	<b>0.000238</b>	<b>0.000468</b>	0.00110 U	0.0000760	HH
PCB 156	<b>0.655 C</b>	<b>0.211 C</b>	<b>0.0138 C</b>	<b>0.0263 C</b>	<b>0.0169 C</b>	<b>0.0280 C</b>	0.250	HH
PCB 157	<b>PCB 156 and 157 are coeluting congeners and are represented with one concentration.</b>						0.250	HH
PCB 167	<b>0.222</b>	<b>0.0971</b>	<b>0.00853</b>	<b>0.0228</b>	<b>0.0121</b>	<b>0.0215</b>	0.250	HH
PCB 169	0.00222 U	0.000487 U	0.000249 U	0.000257 U	0.000350 U	0.000539 U	0.000250	HH
PCB 189	<b>0.0160</b>	<b>0.00548</b>	<b>0.00117</b>	0.00162 EMPC	<b>0.00126</b>	0.00155 EMPC	0.250	HH
Total PCBs as Congeners (KM, capped)	12.4 J	3.12 J	0.591 J	0.825 J	0.816 J	1.34 J	0.570	HH
<b>Metals (mg/kg wet)</b>								
Aluminum	71.4	114	92.8	92.8	100	78.3	--	--
Antimony	<b>0.0150</b>	<b>0.0200</b>	<b>0.0110 J</b>	<b>0.00900 J</b>	<b>0.0110 J</b>	<b>0.0390</b>	--	--
Arsenic	<b>0.380</b>	<b>0.460</b>	<b>0.390</b>	<b>0.390</b>	<b>0.420</b>	<b>0.460</b>	0.000760	HH
Barium	<b>64.9</b>	<b>55.5</b>	<b>59.2</b>	<b>51.7</b>	<b>73.0</b>	<b>58.3</b>	--	--
Beryllium	<b>0.00260 J</b>	<b>0.00340 J</b>	<b>0.00260 J</b>	<b>0.00310 J</b>	<b>0.00300 J</b>	<b>0.00170 J</b>	--	--
Cadmium	<b>0.0870</b>	<b>0.0740</b>	<b>0.0650</b>	<b>0.0730</b>	<b>0.0830</b>	<b>0.0620</b>	0.150	Eco
Chromium	<b>0.500</b>	<b>0.800</b>	<b>0.600</b>	<b>0.700</b>	<b>1.00</b>	<b>0.300</b>	--	--
Cobalt	<b>0.211</b>	<b>0.236</b>	<b>0.213</b>	<b>0.247</b>	<b>0.245</b>	<b>0.262</b>	--	--
Copper	<b>15.5 J</b>	<b>20.3 J</b>	<b>15.6 J</b>	<b>18.8 J</b>	<b>18.9 J</b>	<b>14.8 J</b>	--	--
Lead	<b>0.334 J</b>	<b>0.649 J</b>	<b>0.130 J</b>	<b>0.0980 J</b>	<b>0.140 J</b>	<b>1.41 J</b>	0.120	Eco
Mercury	<b>0.0221</b>	<b>0.0215</b>	<b>0.0263</b>	<b>0.0244</b>	<b>0.0207</b>	<b>0.0208</b>	0.0490	HH
Methyl Mercury	<b>0.0290</b>	<b>0.0290</b>	<b>0.0340</b>	<b>0.0330</b>	<b>0.0250</b>	<b>0.0300</b>	--	--
Nickel	<b>5.35</b>	<b>4.83</b>	<b>4.96</b>	<b>4.71</b>	<b>4.80</b>	<b>4.41</b>	--	--
Thallium	<b>0.0117</b>	<b>0.0155</b>	<b>0.0146</b>	<b>0.0166</b>	<b>0.0166</b>	<b>0.0194</b>	--	--
Vanadium	<b>0.300</b>	<b>0.400</b>	<b>0.400</b>	<b>0.500</b>	<b>0.500</b>	<b>0.400</b>	--	--
Zinc	<b>19.5 J</b>	<b>20.9 J</b>	<b>19.9 J</b>	<b>21.4 J</b>	<b>20.3 J</b>	<b>16.9 J</b>	--	--
<b>Semivolatile Organic Compounds (µg/kg wet)</b>								
Bis(2-ethylhexyl) Phthalate	66.0 U	<b>110 J</b>	66.0 U	66.0 U	66.0 U	<b>88.0 J</b>	81.9	HH
Butyl Benzyl Phthalate	7.30 U	7.30 U	7.30 U	7.30 U	7.30 U	7.30 U	310	Eco
Carbazole	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U	-	-
Di-n-butyl Phthalate	58.0 U	16.0 U	39.0 U	48.0 U	16.0 U	16.0 U	626	Eco
Di-n-octyl Phthalate	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	626	Eco
p-cresol (4-Methylphenol)	7.70 U	7.70 U	7.70 U	7.70 U	7.70 U	7.70 U	-	-
<b>Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (µg/kg wet)</b>								
Acenaphthene	0.110 U	<b>0.130 J</b>	0.110 U	<b>0.140 J</b>	<b>0.200 J</b>	0.110 U	15,000	HH
Anthracene	0.0650 U	<b>0.0690 J</b>	0.0650 U	0.0650 U	<b>0.130 J</b>	0.0650 U	15,000	HH
Fluorene	0.150 U	<b>0.150 J</b>	0.150 U	0.150 U	<b>0.180 J</b>	0.150 U	15,000	HH
Phenanthrene	0.360 U	<b>0.510</b>	0.360 U	<b>0.460 J</b>	<b>0.860</b>	<b>0.510</b>	15,000	HH
<b>High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (µg/kg wet)</b>								
Benzo(a)anthracene	<b>0.230 J</b>	<b>0.260 J</b>	<b>0.260 J</b>	<b>0.270 J</b>	<b>0.350 J</b>	0.0660 U	1.57	HH
Benzo(a)pyrene	0.0810 U	0.0810 U	0.0810 U	0.0810 U	<b>0.170 J</b>	0.0810 U	0.157	HH
Benzo(b)fluoranthene	<b>0.0960 J</b>	<b>0.0980 J</b>	<b>0.110 J</b>	<b>0.140 J</b>	<b>0.220 J</b>	0.0700 U	1.57	HH
Benzo(g,h,i)perylene	0.0730 U	0.0730 U	<b>0.160 J</b>	<b>0.0980 J</b>	<b>0.390 J</b>	0.0730 U	15.7	HH
Benzo(k)fluoranthene	<b>0.0860 J</b>	<b>0.0980 J</b>	<b>0.0970 J</b>	<b>0.110 J</b>	<b>0.160 J</b>	0.0560 U	15.7	HH
Chrysene	<b>0.100 J</b>	<b>0.120 J</b>	0.0760 U	<b>0.140 J</b>	<b>0.310 J</b>	0.0760 U	157	HH
Dibenz(a,h)anthracene	0.0590 U	0.0590 U	0.0590 U	0.0590 U	0.0590 U	0.0590 U	0.157	HH
Fluoranthene	<b>0.170 J</b>	<b>0.260 J</b>	<b>0.230 J</b>	<b>0.300 J</b>	<b>0.750</b>	<b>0.360 J</b>	19,000	Eco
Indeno(1,2,3-cd)pyrene	0.0640 U	0.0640 U	0.0640 U	<b>0.160 J</b>	<b>0.180 J</b>	0.0640 U	1.57	HH
Pyrene	<b>0.160 J</b>	<b>0.290 J</b>	<b>0.280 J</b>	<b>0.340 J</b>	<b>1.20</b>	<b>0.280 J</b>	1,000	Eco

**Notes:**  
 µg/kg = microgram per kilogram  
 mg/kg = milligram per kilogram  
 Eco = Ecological  
 HH = Human Health  
 MDL = method detection limit  
 SLV = screening level value  
 RDL = reported detection limit  
 - = Not Analyzed  
 -- = SLV for analyte not available  
 ND = Non Detect

<sup>1</sup> The crayfish Total PCBs as A

**Table 6-10a**  
**Post-Removal Forebay Area Crayfish Tissue Analytical Results**  
**PCB Aroclors, PCB Dioxin-Like Congeners, Metals, and Semivolatile Organic Compounds**  
**(Page 3 of 3)**

Area	Forebay	Forebay	Forebay	Forebay	Forebay	Selected SLV	SLV Source
Site ID	P17-CF	P18-CF	P19-CF	P20-CF	P21-CF		
Sample ID	08021917CF	08021918CF	08021919CF	08021920CF	08021921CF		
Sample Date	2/19/2008	2/19/2008	2/19/2008	2/19/2008	2/19/2008		
Percent Lipds	0.48	0.73	0.93	0.71	0.72		
<b>PCB Aroclors (µg/kg wet)</b>							
Aroclor 1016	2.40 U	0.570	HH				
Aroclor 1221	2.60 U	0.570	HH				
Aroclor 1232	2.30 U	0.570	HH				
Aroclor 1242	2.20 U	0.570	HH				
Aroclor 1248	0.510 U	0.570	HH				
Aroclor 1254	1.80 U	0.570	HH				
Aroclor 1260	1.90 U	0.570	HH				
Aroclor 1262	2.50 U	0.570	HH				
Aroclor 1268	2.00 U	0.570	HH				
Total PCBs as Aroclors (NDs at MDL) <sup>1</sup>	2.60 U	0.570	HH				
<b>PCB Dioxin-Like Congeners (µg/kg wet)</b>							
PCB 77	<b>0.00157</b>	<b>0.00412</b>	<b>0.00267</b>	<b>0.00338</b>	<b>0.00366</b>	0.0760	HH
PCB 81	0.000164 U	0.000313 EMPC	0.000218 U	<b>0.000211</b>	<b>0.000250</b>	0.0250	HH
PCB 105	<b>0.00636</b>	<b>0.00737</b>	<b>0.0111</b>	<b>0.0110</b>	<b>0.0127</b>	0.250	HH
PCB 114	<b>0.00214</b>	<b>0.00610</b>	0.00261 EMPC	<b>0.00361</b>	<b>0.00389</b>	0.250	HH
PCB 118	<b>0.0824</b>	0.173	<b>0.111</b>	<b>0.152</b>	<b>0.156</b>	0.250	HH
PCB 123	<b>0.00211</b>	<b>0.00506</b>	0.00311 EMPC	<b>0.00362</b>	<b>0.00400</b>	0.250	HH
PCB 126	0.000397 U	<b>0.000469</b>	0.000650 U	0.000748 U	0.000547 U	0.0000760	HH
PCB 156	<b>0.0136 C</b>	<b>0.0257 C</b>	<b>0.0139 C</b>	<b>0.0192 C</b>	<b>0.0191 C</b>	0.250	HH
PCB 156 and 157 are coeluting congeners and are represented with one concentration.							
PCB 157						0.250	HH
PCB 167	<b>0.0118</b>	<b>0.0177</b>	<b>0.0120</b>	<b>0.0141</b>	<b>0.0144</b>	0.250	HH
PCB 169	0.000167 U	0.000254 U	0.000240 U	0.000298 U	0.000265 U	0.000250	HH
PCB 189	<b>0.000926</b>	<b>0.00158</b>	<b>0.000923</b>	0.00109 EMPC	<b>0.00123</b>	0.250	HH
Total PCBs as Congeners (KM, capped)	<b>0.536 J</b>	<b>1.12 J</b>	<b>0.766 J</b>	<b>0.911 J</b>	<b>0.967 J</b>	0.570	HH
<b>Metals (mg/kg wet)</b>							
Aluminum	109	85.6	97.9	103	103	--	--
Antimony	0.0280	0.0190	0.0180	0.0100 J	0.0110 J	--	--
Arsenic	0.410	0.410	0.500	0.440	0.460	0.000760	HH
Barium	54.1	59.9	71.8	64.8	55.3	--	--
Beryllium	0.00380 J	0.00240 J	0.00350 J	0.00330 J	0.00340 J	--	--
Cadmium	0.0620	0.0610	0.128	0.118	0.0810	0.150	Eco
Chromium	0.600	0.700	0.800	0.600	0.700	--	--
Cobalt	0.245	0.235	0.227	0.237	0.261	--	--
Copper	10.5 J	13.0 J	20.4 J	17.4 J	20.0 J	--	--
Lead	0.754 J	0.577 J	0.249 J	0.0990 J	0.106 J	0.120	Eco
Mercury	0.0215	0.0206	0.0214	0.0157	0.0315	0.0490	HH
Methyl Mercury	0.0290	0.0280	0.0260	0.0270	0.0400	--	--
Nickel	5.09	4.62	4.75	4.44	4.49	--	--
Thallium	0.0152	0.0148	0.0214	0.0192	0.0167	--	--
Vanadium	0.500	0.400	0.400	0.400	0.400	--	--
Zinc	18.5 J	19.2 J	20.8 J	19.9 J	21.7 J	--	--
<b>Semivolatile Organic Compounds (µg/kg wet)</b>							
Bis(2-ethylhexyl) Phthalate	66.0 U	81.9	HH				
Butyl Benzyl Phthalate	7.30 U	310	Eco				
Carbazole	9.10 U	-	-				
Di-n-butyl Phthalate	76.0 U	16.0 U	16.0 U	37.0 U	38.0 U	626	Eco
Di-n-octyl Phthalate	11.0 U	626	Eco				
p-cresol (4-Methylphenol)	7.70 U	-	-				
<b>Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (µg/kg wet)</b>							
Acenaphthene	0.110 U	0.110 U	<b>0.210 J</b>	<b>0.110 J</b>	0.110 U	15,000	HH
Anthracene	0.0650 U	15,000	HH				
Fluorene	0.150 U	15,000	HH				
Phenanthrene	<b>0.420 J</b>	<b>0.420 J</b>	0.360 U	0.360 U	<b>0.440 J</b>	15,000	HH
<b>High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (µg/kg wet)</b>							
Benzo(a)anthracene	<b>0.250 J</b>	<b>0.270 J</b>	<b>0.230 J</b>	0.0660 U	0.0660 U	1.57	HH
Benzo(a)pyrene	0.0810 U	0.0810 U	0.0810 U	0.0810 U	<b>0.160 J</b>	0.157	HH
Benzo(b)fluoranthene	0.0700 U	0.0700 U	0.0700 U	0.0700 U	<b>0.240 J</b>	1.57	HH
Benzo(g,h,i)perylene	0.0730 U	0.0730 U	0.0730 U	0.0730 U	<b>0.170 J</b>	15.7	HH
Benzo(k)fluoranthene	0.0560 U	0.0560 U	0.0560 U	0.0560 U	<b>0.150 J</b>	15.7	HH
Chrysene	<b>0.0850 J</b>	<b>0.110 J</b>	<b>0.0820 J</b>	0.0760 U	0.0760 U	157	HH
Dibenz(a,h)anthracene	0.0590 U	0.157	HH				
Fluoranthene	<b>0.320 J</b>	<b>0.450 J</b>	<b>0.250 J</b>	<b>0.230 J</b>	<b>0.500</b>	19,000	Eco
Indeno(1,2,3-cd)pyrene	0.0640 U	0.0640 U	0.0640 U	0.0640 U	<b>0.180 J</b>	1.57	HH
Pyrene	<b>0.290 J</b>	<b>0.450 J</b>	<b>0.230 J</b>	<b>0.200 J</b>	<b>0.380 J</b>	1,000	Eco

**Notes:**

µg/kg = microgram per kilogram  
 mg/kg = milligram per kilogram  
 Eco = Ecological  
 HH = Human Health  
 MDL = method detection limit  
 SLV = screening level value  
 RDL = reported detection limit  
 - = Not Analyzed  
 -- = SLV for analyte not available  
 ND = Non Detect

<sup>1</sup> The crayfish Total PCBs as Aroclors is shown as the maximum MDL because all aroclors were undected in Forebay crayfish samples.

KM, capped = Kaplan-Meier-based with Efron's bias correction, capped

J = The reported value is an estimate.

U = The analyte was not detected at or above the MDL (except PCB congeners).

For PCB congeners, the analyte was not detected at or above the RDL/EMPC.

UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.

EMPC = The analyte was not positively identified; the associated

numerical value is the Estimated Maximum Potential Concentration.

**bold** = analyte detected above MDL/RDL.

= The reported concentration exceeds the selected SLV

**Table 6-10b**  
**Post-Removal Reference Area Crayfish Tissue Analytical Results**  
**PCB Aroclors, PCB Dioxin-Like Congeners, Metals, and Semivolatile Organic Compounds**  
**(Page 1 of 3)**

Area	Reference	Reference	Reference	Reference	Reference	Reference
Site ID	P100-CF	P105-CF	P22-CF	P33-CF	P38/42-CF	P38-CF
Sample ID	080312100CF	080314105CF	08022622CF	0802233CF	08021838/42CF	08021838CF
Sample Date	3/12/2002	3/14/2002	2/26/2008	2/26/2008	2/18/2008	2/18/2008
Percent Lipds	0.76	0.70	0.48	0.68	-	0.44
<b>PCB Aroclors (µg/kg wet)</b>						
Aroclor 1016	2.40 U	3.00 U	2.40 U	2.40 U	-	4.60 U
Aroclor 1221	2.60 U	3.30 U	2.60 U	2.60 U	-	5.00 U
Aroclor 1232	2.30 U	2.90 U	2.30 U	2.30 U	-	4.40 U
Aroclor 1242	2.20 U	2.80 U	2.20 U	2.20 U	-	4.30 U
Aroclor 1248	0.510 U	0.640 U	0.510 U	0.510 U	-	0.980 U
Aroclor 1254	1.80 U	2.30 U	1.80 U	1.80 U	-	3.50 U
Aroclor 1260	1.90 U	2.40 U	1.90 U	1.90 U	-	3.70 U
Aroclor 1262	2.50 U	3.20 U	2.50 U	2.50 U	-	4.80 U
Aroclor 1268	2.00 U	2.50 U	2.00 U	2.00 U	-	3.90 U
Total PCBs as Aroclors (NDs at MDL) <sup>1</sup>	2.60 U	3.30 U	2.60 U	2.60 U	-	5.00 U
<b>PCB Dioxin-Like Congeners (µg/kg wet)</b>						
PCB 77	<b>0.00402</b>	-	<b>0.00130</b>	<b>0.00239</b>	<b>0.00288</b>	-
PCB 81	0.000193 EMPC	-	0.000135 U	<b>0.000176</b>	0.000175 U	-
PCB 105	<b>0.0118</b>	-	<b>0.00197</b>	<b>0.00762</b>	<b>0.00898</b>	-
PCB 114	<b>0.00458</b>	-	<b>0.00262</b>	<b>0.00320</b>	<b>0.00292</b>	-
PCB 118	<b>0.149</b>	-	<b>0.0526</b>	<b>0.0953</b>	<b>0.107</b>	-
PCB 123	<b>0.00417</b>	-	<b>0.00193</b>	<b>0.00271</b>	<b>0.00245</b>	-
PCB 126	<b>0.000481</b>	-	0.000207 U	0.000273 U	<b>0.000377</b>	-
PCB 156	<b>0.0244 C</b>	-	<b>0.0143 C</b>	<b>0.0147 C</b>	<b>0.0127 C</b>	-
PCB 157	PCB 156 and 157 are coeluting congeners and are represented with one concentration.					
PCB 167	<b>0.0180</b>	-	<b>0.00980</b>	<b>0.00944</b>	<b>0.00888</b>	-
PCB 169	0.000325 U	-	0.000180 U	0.000158 U	0.000126 U	-
PCB 189	<b>0.00165</b>	-	<b>0.00124</b>	<b>0.000956</b>	<b>0.000767</b>	-
Total PCBs as Congeners (KM, capped)	<b>0.946 J</b>	-	<b>0.366 J</b>	<b>0.634 J</b>	<b>0.719 J</b>	-
<b>Metals (mg/kg wet)</b>						
Aluminum	<b>124 J</b>	<b>94.2 J</b>	<b>134 J</b>	<b>73.8 J</b>	-	<b>115 J</b>
Antimony	<b>0.0120 J</b>	<b>0.00800 J</b>	<b>0.00900 J</b>	<b>0.0200</b>	-	<b>0.0130 J</b>
Arsenic	<b>0.349</b>	<b>0.378</b>	<b>0.343</b>	<b>0.363</b>	-	<b>0.275</b>
Barium	<b>65.8</b>	<b>40.2</b>	<b>54.8</b>	<b>44.7</b>	-	<b>61.2</b>
Beryllium	<b>0.00320 J</b>	<b>0.00310 J</b>	<b>0.00260 J</b>	<b>0.00330 J</b>	-	<b>0.00370 J</b>
Cadmium	<b>0.121</b>	<b>0.0760</b>	<b>0.0460</b>	<b>0.0480</b>	-	<b>0.0560</b>
Chromium	<b>0.780</b>	<b>0.120 J</b>	<b>1.23</b>	<b>0.310</b>	-	<b>0.170 J</b>
Cobalt	<b>0.280</b>	<b>0.261</b>	<b>0.336</b>	<b>0.372</b>	-	<b>0.347</b>
Copper	<b>17.6 J</b>	<b>19.6 J</b>	<b>16.8 J</b>	<b>13.9 J</b>	-	<b>13.9 J</b>
Lead	<b>0.541</b>	<b>0.183</b>	<b>0.201</b>	<b>0.282</b>	-	<b>0.317</b>
Mercury	<b>0.0183 J</b>	<b>0.0169 J</b>	<b>0.0142 J</b>	<b>0.0137 J</b>	-	<b>0.0172 J</b>
Methyl Mercury	<b>0.0264</b>	<b>0.0364</b>	<b>0.0295</b>	<b>0.0367</b>	-	<b>0.0239</b>
Nickel	<b>2.15</b>	<b>1.28</b>	<b>2.51</b>	<b>1.12</b>	-	<b>1.43</b>
Thallium	<b>0.0200</b>	<b>0.0140</b>	<b>0.0214</b>	<b>0.0214</b>	-	<b>0.0236</b>
Vanadium	<b>0.425</b>	<b>0.378</b>	<b>0.715</b>	<b>0.658</b>	-	<b>0.637</b>
Zinc	<b>19.7</b>	<b>20.6</b>	<b>18.5</b>	<b>18.0</b>	-	<b>21.4</b>
<b>Semivolatile Organic Compounds (µg/kg wet)</b>						
Bis(2-ethylhexyl) Phthalate	66.0 U	-	66.0 U	<b>70.0 J</b>	-	<b>69.0 J</b>
Butyl Benzyl Phthalate	7.30 U	-	7.30 U	7.30 U	-	7.30 U
Carbazole	9.10 U	-	9.10 U	9.10 U	-	9.10 U
Di-n-butyl Phthalate	39.0 U	-	80.0 U	50.0 U	-	92.0 U
Di-n-octyl Phthalate	11.0 U	-	<b>32.0 J</b>	11.0 U	-	11.0 U
p-cresol (4-Methylphenol)	7.70 U	-	7.70 U	7.70 U	-	7.70 U
<b>Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (µg/kg wet)</b>						
Acenaphthene	0.110 U	-	0.110 U	0.110 U	-	0.110 U
Anthracene	0.0650 U	-	0.0650 U	0.0650 U	-	0.0650 U
Fluorene	0.150 U	-	0.150 U	0.150 U	-	0.150 U
Phenanthrene	0.360 U	-	0.360 U	<b>0.460 J</b>	-	0.360 U
<b>High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (µg/kg wet)</b>						
Benzo(a)anthracene	0.0660 U	-	0.0660 U	0.0660 U	-	0.0660 U
Benzo(a)pyrene	0.0810 U	-	0.0810 U	0.0810 U	-	0.0810 U
Benzo(b)fluoranthene	0.0700 U	-	0.0700 U	0.0700 U	-	0.0700 U
Benzo(g,h,i)perylene	0.0730 U	-	0.0730 U	0.0730 U	-	0.0730 U
Benzo(k)fluoranthene	0.0560 U	-	0.0560 U	0.0560 U	-	0.0560 U
Chrysene	0.0760 U	-	0.0760 U	0.0760 U	-	0.0760 U
Dibenz(a,h)anthracene	0.0590 U	-	0.0590 U	0.0590 U	-	0.0590 U
Fluoranthene	0.490 U	-	0.490 U	0.490 U	-	0.500 U
Indeno(1,2,3-cd)pyrene	0.0640 U	-	0.0640 U	0.0640 U	-	0.0640 U
Pyrene	0.490 U	-	0.490 U	0.490 U	-	0.500 U

**Notes:**

µg/kg = microgram per kilogram

mg/kg = milligram per kilogram

MDL = method detection limit

RDL = reported detection limit

ND = Non Detect

- = Not Analyzed

**bold** = analyte detected above MDL/RDL.

J = The reported value is an estimate.

<sup>1</sup> The crayfish Total PCBs as Aroclors is shown as the maximum MDL because all aroclors were undected in Reference Area crayfish samples.

KM, capped = Kaplan-Meier-based with Efron's bias correction, capped

U = The analyte was not detected at or above the MDL (except PCB congeners).

For PCB congeners, the analyte was not detected at or above the RDL/EMPC.

UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.

EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.

**Table 6-10b**  
**Post-Removal Reference Area Crayfish Tissue Analytical Results**  
**PCB Aroclors, PCB Dioxin-Like Congeners, Metals, and Semivolatile Organic Compounds**  
**(Page 2 of 3)**

Area	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Site ID	P42-CF	P72-CF	P73-CF	P74-CF	P75-CF	P76-CF	P78-CF
Sample ID	08022842CF	08030372CF	08030373CF	08030374CF	08030375CF	08030376CF	08030378CF
Sample Date	2/28/2008	3/3/2008	3/3/2008	3/3/2008	3/3/2008	3/3/2008	3/3/2008
Percent Lipds	1.0	0.80	1.0	0.55	0.37	0.70	0.82
<b>PCB Aroclors (µg/kg wet)</b>							
Aroclor 1016	2.40 U	2.40 U	2.40 U	2.40 U	2.40 U	2.40 U	2.40 U
Aroclor 1221	2.60 U	2.60 U	2.60 U	2.60 U	2.60 U	2.60 U	2.60 U
Aroclor 1232	2.30 U	2.30 U	2.30 U	2.30 U	2.30 U	2.30 U	2.30 U
Aroclor 1242	2.20 U	2.20 U	2.20 U	2.20 U	2.20 U	2.20 U	2.20 U
Aroclor 1248	0.510 U	0.510 U	0.510 U	0.510 U	0.510 U	0.510 U	0.510 U
Aroclor 1254	1.80 U	1.80 U	1.80 U	1.80 U	1.80 U	1.80 U	1.80 U
Aroclor 1260	1.90 U	1.90 U	1.90 U	1.90 U	1.90 U	1.90 U	1.90 U
Aroclor 1262	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U
Aroclor 1268	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
Total PCBs as Aroclors <sup>1</sup>	2.60 U	2.60 U	2.60 U	2.60 U	2.60 U	2.60 U	2.60 U
<b>PCB Dioxin-Like Congeners (µg/kg wet)</b>							
PCB 77	-	<b>0.00262</b>	<b>0.00329</b>	<b>0.00299</b>	<b>0.00257</b>	<b>0.00187</b>	<b>0.00209</b>
PCB 81	-	0.000169 U	0.000161 EMPC	<b>0.000167</b>	0.000194 U	0.000127 U	0.000104 U
PCB 105	-	<b>0.00357</b>	<b>0.00603</b>	<b>0.0127</b>	<b>0.0106</b>	<b>0.00301</b>	<b>0.00334</b>
PCB 114	-	<b>0.00369</b>	<b>0.00351</b>	<b>0.00390</b>	<b>0.00364</b>	<b>0.00252</b>	<b>0.00236</b>
PCB 118	-	<b>0.0958</b>	<b>0.111</b>	<b>0.138</b>	<b>0.157</b>	<b>0.0636</b>	<b>0.0697</b>
PCB 123	-	<b>0.00247</b>	<b>0.00307</b>	<b>0.00376</b>	<b>0.00372</b>	<b>0.00196</b>	<b>0.00205</b>
PCB 126	-	<b>0.000450</b>	<b>0.000455</b>	0.000376 U	0.00196 U	0.000231 U	0.000267 U
PCB 156	-	<b>0.0173 C</b>	<b>0.0169 C</b>	<b>0.0188 C</b>	<b>0.0222 C</b>	<b>0.0123 C</b>	<b>0.0130 C</b>
PCB 157	PCB 156 and 157 are coeluting congeners and are represented with one concentration.						
PCB 167	-	<b>0.0106</b>	<b>0.0106</b>	<b>0.0136</b>	<b>0.0167</b>	<b>0.00846</b>	<b>0.00816</b>
PCB 169	-	0.0000992 U	0.000154 U	0.000103 U	0.000171 U	0.000105 U	0.0000911 U
PCB 189	-	<b>0.00133</b>	<b>0.00119</b>	<b>0.00104</b>	<b>0.00125</b>	<b>0.000851</b>	<b>0.000907</b>
Total PCBs as Congeners (KM, capped)	-	<b>0.692 J</b>	<b>0.735 J</b>	<b>0.774 J</b>	<b>0.952 J</b>	<b>0.456 J</b>	<b>0.496 J</b>
<b>Metals (mg/kg wet)</b>							
Aluminum	<b>115 J</b>	<b>221 J</b>	<b>141 J</b>	<b>131 J</b>	<b>137 J</b>	<b>110 J</b>	<b>177 J</b>
Antimony	<b>0.0390</b>	<b>0.0310</b>	<b>0.0260</b>	<b>0.0120 J</b>	<b>0.00800 J</b>	<b>0.0230</b>	<b>0.0150</b>
Arsenic	<b>0.397</b>	<b>0.636</b>	<b>0.460</b>	<b>0.420</b>	<b>0.287</b>	<b>0.356</b>	<b>0.401</b>
Barium	<b>53.4</b>	<b>120</b>	<b>70.7</b>	<b>47.7</b>	<b>47.4</b>	<b>85.7</b>	<b>81.4</b>
Beryllium	<b>0.00320 J</b>	<b>0.00610 J</b>	<b>0.00310 J</b>	<b>0.00390 J</b>	<b>0.00290 J</b>	<b>0.00260 J</b>	<b>0.00340 J</b>
Cadmium	<b>0.0720</b>	<b>0.201</b>	<b>0.0840</b>	<b>0.0840</b>	<b>0.0670</b>	<b>0.116</b>	<b>0.102</b>
Chromium	<b>0.470</b>	<b>0.590</b>	<b>0.280 J</b>	<b>0.140 J</b>	0.130 U	<b>0.160 J</b>	<b>0.280 J</b>
Cobalt	<b>0.339</b>	<b>0.387</b>	<b>0.358</b>	<b>0.397</b>	<b>0.297</b>	<b>0.248</b>	<b>0.356</b>
Copper	<b>18.2 J</b>	<b>33.2 J</b>	<b>19.3 J</b>	<b>18.3 J</b>	<b>13.1 J</b>	<b>17.6 J</b>	<b>19.8 J</b>
Lead	<b>1.04</b>	<b>1.55</b>	<b>0.597</b>	<b>0.0900</b>	<b>0.0560</b>	<b>0.503</b>	<b>0.683</b>
Mercury	<b>0.0151 J</b>	<b>0.0206 J</b>	<b>0.0246 J</b>	<b>0.0169 J</b>	<b>0.0176 J</b>	<b>0.0195 J</b>	<b>0.0153 J</b>
Methyl Mercury	<b>0.0211</b>	<b>0.0299</b>	<b>0.0219</b>	<b>0.0258</b>	<b>0.0268</b>	<b>0.0296</b>	<b>0.0301</b>
Nickel	<b>1.57</b>	<b>2.24</b>	<b>1.36</b>	<b>1.18</b>	<b>0.992</b>	<b>1.30</b>	<b>1.33</b>
Thallium	<b>0.0240</b>	<b>0.0318</b>	<b>0.0192</b>	<b>0.0234</b>	<b>0.0198</b>	<b>0.0158</b>	<b>0.0219</b>
Vanadium	<b>0.711</b>	<b>0.733</b>	<b>0.593</b>	<b>0.710</b>	<b>0.570</b>	<b>0.346</b>	<b>0.494</b>
Zinc	<b>21.1</b>	<b>36.5</b>	<b>22.0</b>	<b>22.3</b>	<b>20.4</b>	<b>20.9</b>	<b>22.1</b>
<b>Semivolatile Organic Compounds (µg/kg wet)</b>							
Bis(2-ethylhexyl) Phthalate	<b>87.0 J</b>	66.0 U					
Butyl Benzyl Phthalate	7.30 U	7.30 U	7.30 U	7.30 U	7.30 U	7.30 U	7.30 U
Carbazole	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U
Di-n-butyl Phthalate	16.0 U	16.0 U	16.0 U	110 U	79.0 U	16.0 U	45.0 U
Di-n-octyl Phthalate	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U
p-cresol (4-Methylphenol)	7.70 U	7.70 U	7.70 U	7.70 U	7.70 U	7.70 U	7.70 U
<b>Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (µg/kg wet)</b>							
Acenaphthene	0.110 U	<b>0.190 J</b>	0.110 U				
Anthracene	0.0650 U	<b>0.190 J</b>	0.0650 U				
Fluorene	0.150 U	<b>0.250 J</b>	0.150 U				
Phenanthrene	0.360 U	<b>0.450 J</b>	0.360 U	0.360 U	0.360 U	0.360 U	<b>0.590</b>
<b>High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (µg/kg wet)</b>							
Benzo(a)anthracene	0.0660 U	<b>0.400 J</b>	0.0660 U	<b>0.310 J</b>	0.0660 U	0.0660 U	0.0660 U
Benzo(a)pyrene	0.0810 U	<b>0.120 J</b>	0.0810 U				
Benzo(b)fluoranthene	0.0700 U	<b>0.230 J</b>	0.0700 U	<b>0.200 J</b>	0.0700 U	0.0700 U	0.0700 U
Benzo(g,h,i)perylene	0.0730 U	0.480 U	0.0730 U	0.500 U	0.0730 U	0.0730 U	0.0730 U
Benzo(k)fluoranthene	0.0560 U	<b>0.200 J</b>	0.0560 U	<b>0.180 J</b>	0.0560 U	0.0560 U	0.0560 U
Chrysene	<b>0.0910 J</b>	<b>0.270 J</b>	0.0760 U	<b>0.260 J</b>	0.0760 U	0.0760 U	0.0760 U
Dibenz(a,h)anthracene	0.0590 U	<b>0.160 J</b>	0.0590 U	<b>0.120 J</b>	0.0590 U	0.0590 U	0.0590 U
Fluoranthene	0.500 U	0.480 U	0.500 U	0.500 U	0.480 U	0.490 U	0.490 U
Indeno(1,2,3-cd)pyrene	0.0640 U	<b>0.180 J</b>	0.0640 U	<b>0.130 J</b>	0.0640 U	0.0640 U	0.0640 U
Pyrene	0.500 U	0.480 U	0.500 U	0.500 U	0.480 U	0.490 U	0.490 U

**Notes:**

µg/kg = microgram per kilogram

mg/kg = milligram per kilogram

MDL = method detection limit

RDL = reported detection limit

**Table 6-10b**  
**Post-Removal Reference Area Crayfish Tissue Analytical Results**  
**PCB Aroclors, PCB Dioxin-Like Congeners, Metals, and Semivolatile Organic Compounds**  
**(Page 3 of 3)**

Area	Reference	Reference	Reference	Reference	Reference	Reference	Reference
<b>Site ID</b>	P79-CF	P82-CF	P90-CF	P91-CF	P92-CF	P94-CF	P98-CF
<b>Sample ID</b>	08030379CF	08030382CF	08031290CF	08031291CF	08031292CF	08031294CF	08031298CF
<b>Sample Date</b>	3/3/2008	3/3/2008	3/12/2008	3/12/2008	3/12/2008	3/12/2008	3/12/2008
<b>Percent Lipds</b>	1.2	0.70	0.23	0.81	0.56	0.50	0.42
<b>PCB Aroclors (µg/kg wet)</b>							
Aroclor 1016	2.40 U	2.40 U	2.40 U	4.80 U	2.40 U	2.40 U	2.40 U
Aroclor 1221	2.60 U	2.60 U	2.60 U	5.20 U	2.60 U	2.60 U	2.60 U
Aroclor 1232	2.30 U	2.30 U	2.30 U	4.60 U	2.30 U	2.30 U	2.30 U
Aroclor 1242	2.20 U	2.20 U	2.20 U	4.40 U	2.20 U	2.20 U	2.20 U
Aroclor 1248	0.510 U	0.510 U	0.510 U	1.10 U	0.510 U	0.510 U	0.510 U
Aroclor 1254	1.80 U	1.80 U	1.80 U	3.60 U	1.80 U	1.80 U	1.80 U
Aroclor 1260	1.90 U	1.90 U	1.90 U	3.80 U	1.90 U	1.90 U	1.90 U
Aroclor 1262	2.50 U	2.50 U	2.50 U	5.00 U	2.50 U	2.50 U	2.50 U
Aroclor 1268	2.00 U	2.00 U	2.00 U	4.00 U	2.00 U	2.00 U	2.00 U
Total PCBs as Aroclors <sup>1</sup>	2.60 U	2.60 U	2.60 U	5.20 U	2.60 U	2.60 U	2.60 U
<b>PCB Dioxin-Like Congeners (µg/kg wet)</b>							
PCB 77	<b>0.00349</b>	<b>0.00466</b>	<b>0.00187</b>	<b>0.00380</b>	<b>0.00190</b>	<b>0.00274</b>	<b>0.00228</b>
PCB 81	0.000162 U	0.000250 EMPC	0.000204 U	0.000188 U	0.000401 U	0.000151 U	0.000146 EMPC
PCB 105	<b>0.00799</b>	<b>0.0248</b>	<b>0.0155</b>	<b>0.0143</b>	<b>0.00225</b>	<b>0.00400</b>	<b>0.00433</b>
PCB 114	<b>0.00356</b>	<b>0.00815</b>	<b>0.00471</b>	<b>0.00417</b>	<b>0.00286</b>	<b>0.00302</b>	<b>0.00347</b>
PCB 118	0.122	0.323	0.264	0.163	0.0697	0.112	0.101
PCB 123	<b>0.00326</b>	<b>0.00736</b>	<b>0.00645</b>	<b>0.00372</b>	<b>0.00226</b>	<b>0.00291</b>	<b>0.00300</b>
PCB 126	<b>0.000530</b>	0.000792 U	0.000329 U	<b>0.000402</b>	0.000275 U	0.000243 EMPC	0.000261 EMPC
PCB 156	0.0188 C	<b>0.0391 C</b>	<b>0.0296 C</b>	0.0204 C	<b>0.0151 C</b>	<b>0.0167 C</b>	<b>0.0201 C</b>
PCB 157	PCB 156 and 157 are coeluting congeners and are represented with one concentration.						
PCB 167	<b>0.0112</b>	<b>0.0301</b>	<b>0.0273</b>	<b>0.0134</b>	<b>0.00947</b>	<b>0.0123</b>	<b>0.0166</b>
PCB 169	0.000114 U	0.000200 U	0.000223 U	0.000237 U	0.000301 U	0.000307 U	0.0000971 U
PCB 189	<b>0.00131</b>	<b>0.00220</b>	<b>0.00129</b>	0.00114 EMPC	<b>0.00131</b>	<b>0.000936</b>	<b>0.00132</b>
Total PCBs as Congeners (KM, capped)	0.876 J	1.94 J	1.12 J	1.02 J	0.498 J	0.650 J	0.609 J
<b>Metals (mg/kg wet)</b>							
Aluminum	167 J	196 J	157 J	124 J	160 J	101 J	71.2 J
Antimony	0.0150	<b>0.00800 J</b>	<b>0.00700 J</b>	<b>0.00600 J</b>	<b>0.00800 J</b>	<b>0.0190</b>	0.0110 J
Arsenic	0.458	0.404	0.280	0.459	0.360	0.338	0.308
Barium	89.0	74.5	49.0	78.2	83.3	79.4	68.6
Beryllium	0.00400 J	<b>0.00420 J</b>	<b>0.00390 J</b>	<b>0.00310 J</b>	<b>0.00400 J</b>	<b>0.00270 J</b>	0.00330 J
Cadmium	0.129	<b>0.0690</b>	<b>0.0520</b>	0.0890	0.147	0.112	0.119
Chromium	0.530	0.780	1.06	0.310	0.530	0.530	0.570
Cobalt	0.350	0.395	0.338	0.439	0.298	0.258	0.224
Copper	28.0 J	17.4 J	12.2 J	18.6 J	19.5 J	14.6 J	13.3 J
Lead	0.387	0.151	0.153	0.0890	0.244	0.416	0.364
Mercury	0.0105 J	0.0181 J	0.0190 J	0.0185 J	0.0221 J	0.0182 J	0.0173 J
Methyl Mercury	0.0254	0.0333	0.0344	0.0221	0.0201	0.0200	0.0181
Nickel	1.87	<b>2.42</b>	3.44	1.82	2.00	1.85	2.36
Thallium	0.0216	<b>0.0254</b>	<b>0.0147</b>	0.0370	0.0197	0.0195	0.0158
Vanadium	0.557	0.754	0.703	0.804	0.509	0.355	0.261
Zinc	24.0	21.6	22.4	20.2	20.9	19.0	18.6
<b>Semivolatile Organic Compounds (µg/kg wet)</b>							
Bis(2-ethylhexyl) Phthalate	66.0 U	66.0 U	66.0 U	66.0 U	<b>76.0 J</b>	66.0 U	66.0 U
Butyl Benzyl Phthalate	7.30 U	<b>15.0 J</b>	<b>18.0 J</b>	7.30 U	7.30 U	7.30 U	<b>31.0 J</b>
Carbazole	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U
Di-n-butyl Phthalate	16.0 U	70.0 U	73.0 U	40.0 U	38.0 U	55.0 U	57.0 U
Di-n-octyl Phthalate	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U
p-cresol (4-Methylphenol)	7.70 U	7.70 U	7.70 U	7.70 U	7.70 U	7.70 U	7.70 U
<b>Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (µg/kg wet)</b>							
Acenaphthene	<b>0.120 J</b>	<b>0.130 J</b>	0.110 U	0.110 U	0.110 U	0.110 U	0.110 U
Anthracene	0.0650 U	<b>0.0980 J</b>	0.0650 U	0.0650 U	0.0650 U	0.0650 U	0.0650 U
Fluorene	0.150 U	<b>0.180 J</b>	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U
Phenanthrene	<b>0.510</b>	<b>0.580</b>	0.360 U	0.360 U	0.360 U	0.360 U	0.360 U
<b>High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (µg/kg wet)</b>							
Benzo(a)anthracene	0.0660 U	0.0660 U	0.0660 U	0.0660 U	0.0660 U	0.0660 U	0.0660 U
Benzo(a)pyrene	0.0810 U	0.0810 U	0.0810 U	0.0810 U	0.0810 U	0.0810 U	0.0810 U
Benzo(b)fluoranthene	0.0700 U	0.0700 U	<b>0.0820 J</b>	0.0700 U	0.0700 U	0.0700 U	<b>0.0860 J</b>
Benzo(g,h,i)perylene	0.0730 U	0.0730 U	0.0730 U	0.0730 U	0.0730 U	0.0730 U	0.490 U
Benzo(k)fluoranthene	0.0560 U	0.0560 U	<b>0.0720 J</b>	0.0560 U	0.0560 U	0.0560 U	<b>0.0920 J</b>
Chrysene	0.0760 U	0.0760 U	<b>0.110 J</b>	0.0760 U	0.0760 U	0.0760 U	<b>0.120 J</b>
Dibenz(a,h)anthracene	0.0590 U	0.0590 U	0.0590 U	0.0590 U	0.0590 U	0.0590 U	<b>0.0720 J</b>
Fluoranthene	0.490 U	0.490 U	0.450 U	0.500 U	0.500 U	0.490 U	0.490 U
Indeno(1,2,3-cd)pyrene	0.0640 U	0.0640 U	0.0640 U	0.0640 U	0.0640 U	0.0640 U	<b>0.0870 J</b>
Pyrene	0.490 U	0.490 U	0.450 U	0.500 U	0.500 U	0.490 U	0.490 U

**Notes:**

µg/kg = microgram per kilogram  
mg/kg = milligram per kilogram  
MDL = method detection limit  
RDL = reported detection limit  
ND = Non Detect  
- = Not Analyzed  
**bold** = analyte detected above MDL/RDL.  
J = The reported value is an estimate.

<sup>1</sup> The crayfish Total PCBs as Aroclors is shown as the maximum MDL because all aroclors were undected in Reference Area crayfish samples.

KM, capped = Kaplan-Meier-based with Efron's bias correction, capped

U = The analyte was not detected at or above the MDL (except PCB congeners).

For PCB congeners, the analyte was not detected at or above the RDL/EMPC.

UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.

EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.

**Table 6-6a**  
**Forebay Area Smallmouth Bass and Largescale Sucker Tissue Analytical Results**  
**PCB Aroclors, PCB Dioxin-Like Congeners, Metals, and Semivolatile Organic Compounds**  
**(Page 1 of 3)**

Area	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	Selected SLV Source
Site ID	1	2	3	4	5	6	7	
Sample ID	060605100SB	060605101SB	060605200SB	060605201SB	060605202SB	060605203SB	060605204SB	
Sample Date	6/5/2006	6/5/2006	6/5/2006	6/5/2006	6/5/2006	6/5/2006	6/5/2006	
Percent Lipids	2	3.2	1.7	1.7	1.4	2.8	3.6	
Tissue Type	Smallmouth Bass	Smallmouth Bass	Smallmouth Bass	Smallmouth Bass	Smallmouth Bass	Smallmouth Bass	Smallmouth Bass	
PCB Aroclors ( $\mu\text{g}/\text{kg}$ wet)								
Aroclor 1016	2.40 UJ	24.0 UJ	2.40 UJ	2.40 UJ	2.40 UJ	2.50 UJ	2.40 UJ	0.570 HH
Aroclor 1221	2.60 UJ	26.0 UJ	2.60 UJ	2.60 UJ	2.60 UJ	2.70 UJ	2.60 UJ	0.570 HH
Aroclor 1232	2.30 UJ	23.0 UJ	2.30 UJ	2.30 UJ	2.30 UJ	2.40 UJ	2.30 UJ	0.570 HH
Aroclor 1242	2.20 UJ	22.0 UJ	2.20 UJ	2.20 UJ	2.20 UJ	2.30 UJ	2.20 UJ	0.570 HH
Aroclor 1248	0.510 UJ	5.10 UJ	68.0 UJ	0.510 UJ	5.00 UJ	12.0 UJ	11.0 UJ	0.570 HH
Aroclor 1254	28.0 UJ	<b>1,300 J</b>	240 UJ	67.0 UJ	<b>51.0 J</b>	95.0 UJ	38.0 UJ	0.570 HH
Aroclor 1260	24.0 UJ	19.0 UJ	150 UJ	48.0 UJ	25.0 UJ	73.0 UJ	37.0 UJ	0.570 HH
Aroclor 1262	2.50 UJ	25.0 UJ	98.0 UJ	21.0 UJ	8.40 UJ	21.0 UJ	12.0 UJ	0.570 HH
Aroclor 1268	2.00 UJ	20.0 UJ	2.00 UJ	2.00 UJ	2.00 UJ	2.10 UJ	2.00 UJ	0.570 HH
Total PCBs as Aroclors (NDs at MDL) <sup>1</sup>	30.2 UJ	<b>1,322 J</b>	242 UJ	69.2 UJ	<b>53.2 J</b>	97.3 UJ	40.2 UJ	0.570 HH
PCB Congeners ( $\mu\text{g}/\text{kg}$ wet)								
PCB 77	<b>0.0241 J</b>	<b>0.165 J</b>	<b>0.205 J</b>	<b>0.0448 J</b>	<b>0.0315 J</b>	<b>0.0703 J</b>	<b>0.0624 J</b>	0.0760 HH
PCB 81	<b>0.00143 J</b>	<b>0.0195 J</b>	<b>0.0238 J</b>	<b>0.00384 J</b>	<b>0.00205 J</b>	<b>0.00422 J</b>	<b>0.00324 J</b>	0.0250 HH
PCB 105	<b>0.966 J</b>	<b>50.4 J</b>	<b>45.5 J</b>	<b>2.98 J</b>	<b>1.23 J</b>	<b>3.54 J</b>	<b>1.54 J</b>	0.250 HH
PCB 114	<b>0.0926 J</b>	<b>3.20 J</b>	<b>4.04 J</b>	<b>0.281 J</b>	<b>0.106 J</b>	<b>0.337 J</b>	<b>0.120 J</b>	0.250 HH
PCB 118	<b>3.31 J</b>	<b>138 J</b>	<b>132 J</b>	<b>8.31 J</b>	<b>3.61 J</b>	<b>10.8 J</b>	<b>3.75 J</b>	0.250 HH
PCB 123	<b>0.0557 J</b>	<b>1.60 J</b>	<b>2.45 J</b>	<b>0.118 J</b>	<b>0.0633 J</b>	<b>0.217 J</b>	<b>0.0695 J</b>	0.250 HH
PCB 126	<b>0.00505 J</b>	<b>0.0553 J</b>	<b>0.0755 J</b>	<b>0.00974 J</b>	<b>0.00807 J</b>	<b>0.0159 J</b>	<b>0.0111 J</b>	0.0000760 HH
PCB 156	<b>0.654 C J</b>	<b>26.6 C J</b>	<b>31.4 C J</b>	<b>2.22 C J</b>	<b>0.735 C J</b>	<b>2.89 C J</b>	<b>0.846 C J</b>	0.250 HH
PCB 157	PCB 156 and 157 are coeluting congeners and are represented with one concentration.							0.250 HH
PCB 167	<b>0.226 J</b>	<b>6.50 J</b>	<b>9.65 J</b>	<b>0.428 J</b>	<b>0.239 J</b>	<b>0.961 J</b>	<b>0.250 J</b>	0.250 HH
PCB 169	0.00152 UJ	0.00728 UJ	0.00449 UJ	0.00275 UJ	0.00129 UJ	0.00503 UJ	0.00260 UJ	0.000250 HH
PCB 189	<b>0.0216 J</b>	<b>0.482 J</b>	<b>0.531 J</b>	<b>0.0759 J</b>	<b>0.0250 J</b>	<b>0.113 J</b>	<b>0.0390 J</b>	0.250 HH
Total PCBs as Congeners (KM, capped)	<b>33.7 J</b>	<b>1440 J</b>	<b>879 J</b>	<b>96.7 J</b>	<b>42.0 J</b>	<b>137 J</b>	<b>59.3 J</b>	0.570 HH
Metals ( $\text{mg}/\text{kg}$ wet)								
Aluminum	<b>9.89</b>	<b>6.66</b>	<b>11.3</b>	<b>4.00</b>	<b>4.75</b>	<b>1.26 J</b>	<b>1.37</b>	- -
Antimony	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U	- -
Arsenic	<b>0.170</b>	<b>0.700</b>	<b>0.170</b>	<b>0.390</b>	<b>0.330</b>	<b>0.350</b>	<b>0.560</b>	0.000760 HH
Barium	<b>2.32</b>	<b>1.30</b>	<b>1.95</b>	<b>2.43</b>	<b>1.73</b>	<b>0.870</b>	<b>0.960</b>	- -
Beryllium	<b>0.000600</b>	<b>0.000500</b>	<b>0.000500 U</b>	<b>0.000500 U</b>	<b>0.000500 U</b>	<b>0.000700</b>	<b>0.000600</b>	- -
Cadmium	<b>0.0110</b>	<b>0.00700</b>	<b>0.0230</b>	<b>0.00600</b>	<b>0.00600</b>	<b>0.0110</b>	<b>0.00700</b>	0.150 Eco
Chromium	<b>0.190</b>	0.130 U	<b>0.270</b>	0.120 U	<b>0.290</b>	0.140 U	0.130 U	- -
Cobalt	<b>0.0553</b>	<b>0.0516</b>	<b>0.0582</b>	<b>0.0452</b>	<b>0.0537</b>	<b>0.0594</b>	<b>0.0447</b>	- -
Copper	<b>1.06</b>	<b>0.583</b>	<b>1.42</b>	<b>0.721</b>	<b>0.767</b>	<b>0.482</b>	<b>0.439</b>	- -
Lead	<b>0.0200</b>	<b>0.0180</b>	<b>0.00800</b>	<b>0.0170</b>	<b>0.00900</b>	<b>0.00500 J</b>	<b>0.00500</b>	0.120 Eco
Mercury	<b>0.0710 J</b>	<b>0.342 J</b>	<b>0.131 J</b>	<b>0.187 J</b>	<b>0.0760 J</b>	<b>0.283 J</b>	<b>0.315 J</b>	0.0490 HH
Methyl Mercury	-	-	-	-	-	-	-	- -
Nickel	<b>0.309</b>	<b>0.271</b>	<b>0.399</b>	<b>0.225</b>	<b>0.357</b>	<b>0.304 J</b>	<b>0.213</b>	- -
Thallium	<b>0.0148</b>	<b>0.0198</b>	<b>0.0112</b>	<b>0.0146</b>	<b>0.0154</b>	<b>0.00930</b>	<b>0.0177</b>	- -
Vanadium	<b>0.0700</b>	<b>0.0400</b>	<b>0.0600</b>	<b>0.0400</b>	<b>0.0400</b>	<b>0.0300</b>	<b>0.0300</b>	- -
Zinc	<b>13.9</b>	<b>12.9</b>	<b>15.1</b>	<b>15.1</b>	<b>14.8</b>	<b>18.0</b>	<b>12.2</b>	- -
Semivolatile Organic Compounds ( $\mu\text{g}/\text{kg}$ wet)								
Bis(2-ethylhexyl) Phthalate	66.0 UJ	<b>140 J</b>	<b>100 J</b>	66.0 UJ	66.0 UJ	<b>130 J</b>	<b>89.0 J</b>	81.9 HH
Butyl Benzyl Phthalate	7.30 UJ	7.30 UJ	7.30 UJ	7.30 UJ	7.30 UJ	7.30 UJ	7.30 UJ	310 Eco
Carbazole	9.10 UJ	9.10 UJ	9.10 UJ	9.10 UJ	9.10 UJ	9.10 UJ	9.10 UJ	- -
Di-n-butyl Phthalate	16.0 UJ	48.0 UJ	16.0 UJ	16.0 UJ	36.0 UJ	16.0 UJ	16.0 UJ	626 Eco
Di-n-octyl Phthalate	11.0 UJ	11.0 UJ	11.0 UJ	11.0 UJ	11.0 UJ	11.0 UJ	11.0 UJ	626 Eco
p-cresol (4-Methylphenol)	7.70 UJ	7.70 UJ	7.70 UJ	7.70 UJ	7.70 UJ	7.70 UJ	7.70 UJ	- -
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) ( $\mu\text{g}/\text{kg}$ wet)								
Acenaphthene	<b>0.200 J</b>	0.110 UJ	<b>0.300 J</b>	<b>0.160 J</b>	<b>0.200 J</b>	<b>0.790 J</b>	0.110 UJ	15,000 HH
Anthracene	<b>0.110 J</b>	<b>0.230 J</b>	<b>0.320 J</b>	<b>0.0780 J</b>	<b>0.180 J</b>	<b>2.20 J</b>	<b>0.320 J</b>	15,000 HH
Fluorene	<b>0.410 J</b>	0.150 UJ	<b>0.670 J</b>	<b>0.300 J</b>	<b>0.370 J</b>	<b>1.30 J</b>	<b>0.970</b>	15,000 HH
Phenanthrene	<b>0.610</b>	<b>1.30</b>	<b>0.870 J</b>	<b>0.540</b>	<b>0.790</b>	<b>2.20 J</b>	<b>1.60</b>	15,000 HH
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) ( $\mu\text{g}/\text{kg}$ wet)								
Benzo(a)anthracene	0.0660 UJ	0.0660 UJ	<b>1.20 J</b>	0.0660 UJ	0.0660 UJ	<b>5.00 J</b>	0.0660 UJ	1.57 HH
Benzo(a)pyrene	0.0810 UJ	0.0810 UJ	<b>0.770 J</b>	0.0810 UJ	0.0810 UJ	<b>3.50 J</b>	0.0810 UJ	0.157 HH
Benzo(b)fluoranthene	<b>0.110 J</b>	0.0700 UJ	0.140 UJ	0.0700 UJ	0.0700 UJ	<b>2.20 J</b>	0.0700 UJ	1.57 HH
Benzo(g,h,i)perylene	0.0730 UJ	0.0730 UJ	<b>0.420 J</b>	0.0730 UJ	0.0730 UJ	<b>1.50 J</b>	0.0730 UJ	15.7 HH
Benzo(k)fluoranthene	<b>0.110 J</b>	0.0560 UJ	<b>1.40 J</b>	0.0560 UJ	0.0560 UJ	<b>3.80 J</b>	0.0560 UJ	15.7 HH
Chrysene	0.0760 UJ	0.0760 UJ	<b>0.530 J</b>	0.				

**Table 6-6a**  
**Forebay Area Smallmouth Bass and Largescaler Sucker Tissue Analytical Results**  
**PCB Aroclors, PCB Dioxin-Like Congeners, Metals, and Semivolatile Organic Compounds**  
**(Page 2 of 3)**

Area	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	Selected SLV	SLV Source
Site ID	12	13	14	8	9	10	11		
Sample ID	060606102SB	060606103SB	060606104SB	060605205SB	060605207SB	060605208SB	060605209SB		
Sample Date	6/6/2006	6/6/2006	6/6/2006	6/5/2006	6/5/2006	6/5/2006	6/5/2006		
Percent Lipids	2.1	2.4	2.4	2.8	2.5	2.4	4.1		
Tissue Type	Smallmouth Bass	Smallmouth Bass	Smallmouth Bass	Smallmouth Bass	Smallmouth Bass	Smallmouth Bass	Smallmouth Bass		
<b>PCB Aroclors (µg/kg wet)</b>									
Aroclor 1016	2.40 UJ	120 UJ	6.00 UJ	24.0 UJ	4.70 UJ	2.40 UJ	240 UJ	0.570	HH
Aroclor 1221	2.60 UJ	20.0 UJ	32.0 UJ	26.0 UJ	25.0 UJ	2.60 UJ	260 UJ	0.570	HH
Aroclor 1232	2.30 UJ	8.90 UJ	12.0 UJ	23.0 UJ	14.0 UJ	2.30 UJ	230 UJ	0.570	HH
Aroclor 1242	2.20 UJ	3.80 UJ	10.0 UJ	22.0 UJ	4.40 UJ	2.20 UJ	220 UJ	0.570	HH
Aroclor 1248	33.0 UJ	61.0 UJ	4.20 UJ	5.10 UJ	9.10 UJ	12.0 UJ	51.0 UJ	0.570	HH
Aroclor 1254	85.0 UJ	420 UJ	11.0 UJ	<b>1,300 J</b>	25.0 UJ	96.0 UJ	<b>14,000 J</b>	0.570	HH
Aroclor 1260	300 UJ	200 UJ	26.0 UJ	19.0 UJ	67.0 UJ	78.0 UJ	190 UJ	0.570	HH
Aroclor 1262	110 UJ	160 UJ	16.0 UJ	25.0 UJ	24.0 UJ	50.0 UJ	250 UJ	0.570	HH
Aroclor 1268	5.90 UJ	9.90 UJ	5.00 UJ	20.0 UJ	6.40 UJ	16.0 UJ	200 UJ	0.570	HH
Total PCBs as Aroclors (NDs at MDL) <sup>1</sup>	87.2 UJ	424 UJ	21.0 UJ	<b>1,322 J</b>	29.4 UJ	98.2 UJ	<b>14,220 J</b>	0.570	HH
<b>PCB Congeners (µg/kg wet)</b>									
PCB 77	<b>0.102 J</b>	<b>0.186 J</b>	<b>0.0217 J</b>	<b>0.214 J</b>	<b>0.0367 J</b>	<b>0.0772 J</b>	<b>3.53 J</b>	0.0760	HH
PCB 81	<b>0.00807 J</b>	<b>0.0117 J</b>	<b>0.00121 J</b>	<b>0.0191 J</b>	<b>0.00233 J</b>	<b>0.00576 J</b>	0.0231 UJ	0.0250	HH
PCB 105	<b>11.2 J</b>	<b>57.7 J</b>	<b>0.717 J</b>	<b>66.3 J</b>	<b>2.09 J</b>	<b>3.91 J</b>	<b>766 J</b>	0.250	HH
PCB 114	<b>1.68 J</b>	<b>4.47 J</b>	<b>0.0594 J</b>	<b>4.87 J</b>	<b>0.173 J</b>	<b>0.332 J</b>	<b>65.7 J</b>	0.250	HH
PCB 118	<b>52.4 J</b>	<b>164 J</b>	<b>2.42 J</b>	<b>199 J</b>	<b>6.43 J</b>	<b>10.3 J</b>	<b>2,180 J</b>	0.250	HH
PCB 123	<b>0.948 J</b>	<b>2.07 J</b>	<b>0.0323 J</b>	<b>1.94 J</b>	<b>0.0810 J</b>	<b>0.136 J</b>	<b>35.6 J</b>	0.250	HH
PCB 126	<b>0.0262 J</b>	<b>0.0453 J</b>	<b>0.00642 J</b>	<b>0.0857 J</b>	<b>0.00890 J</b>	<b>0.0143 J</b>	<b>1.26 J</b>	0.0000760	HH
PCB 156	<b>12.8 C J</b>	<b>38.6 C J</b>	<b>0.541 C J</b>	<b>44.6 C J</b>	<b>1.36 C J</b>	<b>2.39 C J</b>	<b>403 C J</b>	0.250	HH
PCB 157	<b>PCB 156 and 157 are coeluting congeners and are represented with one concentration.</b>							0.250	HH
PCB 167	<b>3.65 J</b>	<b>7.99 J</b>	<b>0.161 J</b>	<b>9.35 J</b>	<b>0.311 J</b>	<b>0.574 J</b>	<b>116 J</b>	0.250	HH
PCB 169	0.00824 UJ	0.0145 UJ	0.00347 UJ	0.0112 UJ	0.00327 UJ	0.00508 UJ	0.127 UJ	0.000250	HH
PCB 189	<b>0.324 J</b>	<b>0.661 J</b>	<b>0.0311 J</b>	<b>0.841 J</b>	<b>0.0491 J</b>	<b>0.0910 J</b>	<b>9.30 J</b>	0.250	HH
Total PCBs as Congeners (KM, capped)	325 J	1306 J	32.1 J	1733 J	69.6 J	149 J	19303 J	0.570	HH
<b>Metals (mg/kg wet)</b>									
Aluminum	<b>15.5</b>	<b>2.49</b>	<b>1.06</b>	<b>4.72</b>	<b>2.25</b>	<b>1.33</b>	<b>3.90</b>	-	-
Antimony	0.00500 U	0.00600 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00600 U	-	-
Arsenic	<b>0.310</b>	<b>0.350</b>	<b>0.560</b>	<b>0.520</b>	<b>0.450</b>	<b>0.490</b>	<b>0.600</b>	0.000760	HH
Barium	<b>1.34</b>	<b>1.28</b>	<b>0.720</b>	<b>1.13</b>	<b>0.860</b>	<b>1.57</b>	<b>1.96</b>	-	-
Beryllium	0.000500 U	0.000600 U	0.000500 U	0.000500 U	0.000500 U	0.000500 U	0.000600 U	-	-
Cadmium	<b>0.00700</b>	<b>0.00400</b>	<b>0.0190</b>	<b>0.0130</b>	<b>0.00900</b>	<b>0.00400</b>	<b>0.00600</b>	0.150	Eco
Chromium	<b>0.200</b>	0.150 U	0.120 U	0.130 U	0.120 U	0.140 U	0.140 U	-	-
Cobalt	<b>0.0567</b>	<b>0.0758</b>	<b>0.0469</b>	<b>0.0588</b>	<b>0.0441</b>	<b>0.0575</b>	<b>0.0650</b>	-	-
Copper	<b>0.688</b>	<b>0.540</b>	<b>0.560</b>	<b>0.769</b>	<b>0.586</b>	<b>0.434</b>	<b>0.588</b>	-	-
Lead	<b>0.00900</b>	<b>0.00500</b>	<b>0.0100</b>	<b>0.00500</b>	<b>0.0100</b>	<b>0.00400</b>	<b>0.00500</b>	0.120	Eco
Mercury	<b>0.131 J</b>	<b>0.512 J</b>	<b>0.383 J</b>	<b>0.367 J</b>	<b>0.305 J</b>	<b>0.372 J</b>	<b>0.251 J</b>	0.0490	HH
Methyl Mercury	-	-	-	-	-	-	-	-	-
Nickel	<b>0.282</b>	<b>0.392</b>	<b>0.273</b>	<b>0.324</b>	<b>0.213</b>	<b>0.292</b>	<b>0.338</b>	-	-
Thallium	<b>0.0188</b>	<b>0.0128</b>	<b>0.0153</b>	<b>0.0157</b>	<b>0.0162</b>	<b>0.0133</b>	<b>0.0153</b>	-	-
Vanadium	<b>0.130</b>	<b>0.0700</b>	<b>0.0600</b>	<b>0.0500</b>	<b>0.0400</b>	<b>0.0500</b>	<b>0.0500</b>	-	-
Zinc	<b>12.3</b>	<b>15.5</b>	<b>16.1</b>	<b>14.8</b>	<b>13.3</b>	<b>13.3</b>	<b>14.4</b>	-	-
<b>Semivolatile Organic Compounds (µg/kg wet)</b>									
Bis(2-ethylhexyl) Phthalate	66.0 UJ	66.0 UJ	<b>120 J</b>	<b>190</b>	66.0 UJ	66.0 UJ	66.0 UJ	81.9	HH
Butyl Benzyl Phthalate	7.30 UJ	7.30 UJ	<b>33.0 J</b>	7.30 UJ	7.30 UJ	7.30 UJ	7.30 UJ	310	Eco
Carbazole	9.10 UJ	9.10 UJ	9.10 UJ	9.10 UJ	9.10 UJ	9.10 UJ	9.10 UJ	-	-
Di-n-butyl Phthalate	16.0 UJ	71.0 UJ	<b>150 J</b>	16.0 UJ	16.0 UJ	37.0 UJ	16.0 UJ	626	Eco
Di-n-octyl Phthalate	11.0 UJ	11.0 UJ	11.0 UJ	11.0 UJ	11.0 UJ	11.0 UJ	11.0 UJ	626	Eco
p-cresol (4-Methylphenol)	7.70 UJ	7.70 UJ	7.70 UJ	7.70 UJ	7.70 UJ	7.70 UJ	7.70 UJ	-	-
<b>Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (µg/kg wet)</b>									
Acenaphthene	<b>0.260 J</b>	<b>0.280 J</b>	<b>0.230 J</b>	<b>0.260 J</b>	0.110 UJ	<b>0.390 J</b>	<b>0.350 J</b>	15,000	HH
Anthracene	<b>0.220 J</b>	<b>0.320 J</b>	0.0650 UJ	<b>0.160 J</b>	<b>0.170 J</b>	<b>0.450 J</b>	<b>0.450 J</b>	15,000	HH
Fluorene	<b>0.460 J</b>	<b>0.670</b>	<b>0.550</b>	<b>0.650</b>	<b>0.400 J</b>	<b>0.850 J</b>	0.150 UJ	15,000	HH
Phenanthrene	<b>1.00</b>	<b>1.90</b>	<b>0.760</b>	<b>1.10</b>	<b>0.980</b>	<b>2.00 J</b>	<b>2.10</b>	15,000	HH
<b>High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (µg/kg wet)</b>									
Benzo(a)anthracene	0.0660 UJ	0.0660 UJ	0.0660 UJ	0.0660 UJ	0.0660 UJ	<b>1.00 J</b>	0.0660 UJ	1.57	HH
Benzo(a)pyrene	0.0810 UJ	0.0810 UJ	0.0810 UJ	0.0810 UJ	0.0810 UJ	<b>0.720 J</b>	0.0810 UJ	0.157	HH
Benzo(b)fluoranthene	0.0700 UJ	0.0700 UJ	0.0700 UJ	0.0700 UJ	0.0700 UJ	0.140 UJ	0.0700 UJ	1.57	HH
Benzo(g,h,i)perylene	0.0730 UJ	0.0730 UJ	0.						

**Table 6-6a**  
**Forebay Area Smallmouth Bass and Largescale Sucker Tissue Analytical Results**  
**PCB Aroclors, PCB Dioxin-Like Congeners, Metals, and Semivolatile Organic Compounds**  
**(Page 3 of 3)**

Area	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay		
Site ID	15	16	17	18	19	SUCKER	Selected SLV	SLV Source
Sample ID	060606210SB	060815402SB	060815403SB	060815405SB	060815406SB	070505LS		
Sample Date	6/6/2006	8/15/2006	8/15/2006	8/15/2006	8/15/2006	5/5/2007		
Percent Lipids	1.7	5.3	5.5	4.7	6.6	10.4		
Tissue Type	Smallmouth Bass	Smallmouth Bass	Smallmouth Bass	Smallmouth Bass	Smallmouth Bass	Largescale Sucker		
<b>PCB Aroclors (µg/kg wet)</b>								
Aroclor 1016	10.0 UJ	2.40 UJ	120 UJ	24.0 UJ	9.90 UJ	2.40 U	0.570	HH
Aroclor 1221	20.0 UJ	2.60 UJ	130 UJ	26.0 UJ	2.60 UJ	2.60 U	0.570	HH
Aroclor 1232	10.0 UJ	2.30 UJ	120 UJ	23.0 UJ	9.90 UJ	2.30 U	0.570	HH
Aroclor 1242	8.50 UJ	<b>260 J</b>	110 UJ	22.0 UJ	4.70 UJ	2.20 U	0.570	HH
Aroclor 1248	10.0 UJ	0.510 UJ	26.0 UJ	5.10 UJ	5.70 UJ	0.510 U	0.570	HH
Aroclor 1254	16.0 UJ	<b>330 J</b>	<b>18,000 J</b>	<b>1,400 J</b>	13.0 UJ	<b>160</b>	0.570	HH
Aroclor 1260	31.0 UJ	1.90 UJ	95.0 UJ	19.0 UJ	37.0 UJ	1.90 U	0.570	HH
Aroclor 1262	10.0 UJ	2.50 UJ	130 UJ	25.0 UJ	12.0 UJ	-	0.570	HH
Aroclor 1268	2.50 UJ	2.00 UJ	100 UJ	20.0 UJ	3.50 UJ	2.00 U	0.570	HH
Total PCBs as Aroclors (NDs at MDL) <sup>1</sup>	24.5 UJ	<b>590 J</b>	<b>18,110 J</b>	<b>1,422 J</b>	17.7 UJ	<b>160</b>	0.570	HH
<b>PCB Congeners (µg/kg wet)</b>								
PCB 77	<b>0.0236 J</b>	<b>0.334 J</b>	<b>8.95 J</b>	<b>0.577 J</b>	<b>0.0568 J</b>	<b>0.110</b>	0.0760	HH
PCB 81	<b>0.00130 J</b>	<b>0.0198 J</b>	<b>1.19 J</b>	0.00615 UJ	<b>0.00358 J</b>	<b>0.00902</b>	0.0250	HH
PCB 105	<b>1.60 J</b>	<b>30.1 J</b>	<b>1,300 J</b>	<b>109 J</b>	<b>0.738 J</b>	<b>4.35</b>	0.250	HH
PCB 114	<b>0.122 J</b>	<b>2.33 J</b>	<b>89.8 J</b>	<b>11.2 J</b>	<b>0.115 J</b>	<b>0.289</b>	0.250	HH
PCB 118	<b>4.97 J</b>	<b>92.1 J</b>	<b>3,270 J</b>	<b>312 J</b>	<b>3.82 J</b>	<b>10.3</b>	0.250	HH
PCB 123	<b>0.0574 J</b>	<b>1.20 J</b>	<b>55.3 J</b>	<b>6.10 J</b>	<b>0.0750 J</b>	<b>0.179</b>	0.250	HH
PCB 126	<b>0.00755 J</b>	0.0480 UJ	<b>3.03 J</b>	<b>0.125 J</b>	<b>0.0123 J</b>	<b>0.0191</b>	0.0000760	HH
PCB 156	<b>1.20 C J</b>	<b>16.9 C J</b>	<b>486 C J</b>	<b>83.0 C J</b>	<b>0.791 C J</b>	<b>1.77 C</b>	0.250	HH
PCB 157	PCB 156 and 157 are coeluting congeners and are represented with one concentration.						0.250	HH
PCB 167	<b>0.270 J</b>	<b>4.71 J</b>	<b>140 J</b>	<b>21.0 J</b>	<b>0.356 J</b>	<b>0.565</b>	0.250	HH
PCB 169	0.00318 UJ	0.0151 UJ	0.607 UJ	0.0280 UJ	0.00439 UJ	<b>0.0111</b>	0.000250	HH
PCB 189	<b>0.0407 J</b>	<b>0.402 J</b>	<b>10.1 J</b>	<b>1.88 J</b>	<b>0.0419 J</b>	<b>0.0780</b>	0.250	HH
Total PCBs as Congeners (KM, capped)	<b>54.8 J</b>	<b>1193 J</b>	<b>26505 J</b>	<b>2482 J</b>	<b>40.7 J</b>	<b>201 J</b>	0.570	HH
<b>Metals (mg/kg wet)</b>								
Aluminum	<b>10.3</b>	<b>4.24</b>	<b>1.33</b>	<b>1.97</b>	<b>7.54</b>	<b>19.7 J</b>	-	-
Antimony	0.00500 U	0.00600 U	0.00600 U	0.00600 U	0.00500 U	0.00600 U	-	-
Arsenic	<b>0.540</b>	<b>0.190</b>	<b>0.290</b>	<b>0.450</b>	<b>0.410</b>	<b>0.350</b>	0.000760	HH
Barium	<b>0.980</b>	<b>2.64</b>	<b>1.74</b>	<b>1.24</b>	<b>1.66</b>	<b>1.92</b>	-	-
Beryllium	0.000500 U	0.000600 U	0.000600 U	0.000600 U	0.000500 U	0.000600 U	-	-
Cadmium	<b>0.0280</b>	<b>0.00500</b>	<b>0.00700</b>	<b>0.00500</b>	<b>0.00700</b>	<b>0.0420</b>	0.150	Eco
Chromium	<b>0.860</b>	0.150 U	0.150 U	0.150 U	0.130 U	<b>0.480</b>	-	-
Cobalt	<b>0.0519</b>	<b>0.0625</b>	<b>0.0566</b>	<b>0.0508</b>	<b>0.0457</b>	<b>0.0775</b>	-	-
Copper	<b>0.619</b>	<b>0.905</b>	<b>0.591</b>	<b>0.364</b>	<b>0.505</b>	<b>0.728</b>	-	-
Lead	<b>0.0360</b>	<b>0.0120</b>	<b>0.00800</b>	<b>0.0160</b>	<b>0.00500</b>	<b>0.0440</b>	0.120	Eco
Mercury	<b>0.203 J</b>	<b>0.301 J</b>	<b>0.165 J</b>	<b>0.498 J</b>	<b>0.147 J</b>	<b>0.139 J</b>	0.0490	HH
Methyl Mercury	-	-	-	-	-	-	-	-
Nickel	<b>0.333</b>	<b>0.327</b>	<b>0.295</b>	<b>0.281</b>	<b>0.228</b>	<b>0.343</b>	-	-
Thallium	<b>0.0215</b>	<b>0.00790</b>	<b>0.0136</b>	<b>0.0145</b>	<b>0.0142</b>	<b>0.00560</b>	-	-
Vanadium	<b>0.0500</b>	<b>0.0800</b>	<b>0.0700</b>	<b>0.0800</b>	<b>0.0900</b>	<b>0.170</b>	-	-
Zinc	<b>13.4</b>	<b>15.8</b>	<b>14.9</b>	<b>13.2</b>	<b>11.4</b>	<b>17.5</b>	-	-
<b>Semivolatile Organic Compounds (µg/kg wet)</b>								
Bis(2-ethylhexyl) Phthalate	<b>1,600</b>	5,000 U	66.0 UJ	66.0 UJ	66.0 UJ	66.0 U	81.9	HH
Butyl Benzyl Phthalate	7.30 UJ	<b>440</b>	7.30 UJ	7.30 UJ	7.30 UJ	7.30 U	310	Eco
Carbazole	9.10 UJ	9.10 UJ	9.10 UJ	9.10 UJ	9.10 UJ	9.10 U	-	-
Di-n-butyl Phthalate	16.0 UJ	16.0 UJ	16.0 UJ	16.0 UJ	16.0 UJ	16.0 U	626	Eco
Di-n-octyl Phthalate	11.0 UJ	11.0 UJ	11.0 UJ	11.0 UJ	11.0 UJ	11.0 U	626	Eco
p-cresol (4-Methylphenol)	7.70 UJ	7.70 UJ	7.70 UJ	7.70 UJ	7.70 UJ	7.70 U	-	-
<b>Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (µg/kg wet)</b>								
Acenaphthene	<b>0.300 J</b>	<b>1.40 J</b>	<b>1.50 J</b>	<b>1.50 J</b>	<b>1.60 J</b>	1.10 U	15,000	HH
Anthracene	<b>0.400 J</b>	<b>17.0 J</b>	<b>5.70 J</b>	<b>6.00 J</b>	<b>6.60 J</b>	<b>4.50 J</b>	15,000	HH
Fluorene	<b>0.520 J</b>	<b>4.70 J</b>	<b>2.40 J</b>	<b>3.70 J</b>	<b>3.30 J</b>	1.50 U	15,000	HH
Phenanthrene	<b>1.00 J</b>	<b>5.70 J</b>	<b>4.60 J</b>	<b>5.20 J</b>	<b>5.40 J</b>	<b>3.80 J</b>	15,000	HH
<b>High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (µg/kg wet)</b>								
Benzo(a)anthracene	<b>1.20 J</b>	<b>17.0 J</b>	0.660 UJ	0.660 UJ	0.660 UJ	0.660 U	1.57	HH
Benzo(a)pyrene	<b>0.740 J</b>	<b>6.80 J</b>	<b>7.10 J</b>	<b>6.40 J</b>	<b>7.40 J</b>	<b>6.30</b>	0.157	HH
Benzo(b)fluoranthene	0.140 UJ	4.20 J	<b>3.90 J</b>	<b>4.40 J</b>	<b>4.40 J</b>	0.700 U	1.57	HH
Benzo(g,h,i)perylene	0.150 UJ	<b>2.60 J</b>	<b>2.80 J</b>	<b>3.10 J</b>	<b>3.30 J</b>	<b>2.00 J</b>	15.7	HH
Benzo(k)fluoranthene	<b>1.60 J</b>	<b>7.70 J</b>	<b>7.20 J</b>	<b>7.20 J</b>	<b>7.60 J</b>	<b>11.0</b>	15.7	HH
Chrysene	<b>0.620 J</b>	<b>10.0 J</b>	<b>4.50 J</b>	<b>4.60 J</b>	<b>4.90 J</b>	0.760 U	157	HH
Dibenz(a,h)anthracene	0.120 UJ	<b>3.40 J</b>	<b>3.40 J</b>	<b>3.40 J</b>	<b>4.10 J</b>	<b>3.70 J</b>	0.157	HH
Fluoranthene	<b>0.960 J</b>	<b>5.90 J</b>	<b>5.90 J</b>	6.30 J	<b>6.50 J</b>	<b>5.90</b>	19,000	Eco
Indeno(1,2,3-cd)pyrene	0.130 UJ	<b>5.60 J</b>	<b>5.30 J</b>	<b>6.00 J</b>	<b>6.10 J</b>	<b>6.50</b>	1.57	HH
Pyrene	<b>0.670 J</b>	<b>7.20 J</b>	<b>4.90 J</b>	<b>5.00 J</b>	<b>5.30 J</b>	7.40	1,000	Eco

**Table 6-6b**  
**Reference Area Smallmouth Bass Tissue Analytical Results**  
**PCB Aroclors, PCB Dioxin-Like Congeners, Metals, and Semivolatile Organic Compounds**  
**(Page 1 of 3)**

Area	Reference	Reference	Reference	Reference	Reference	Reference
Site ID	20	21	22	23	24	25
Sample ID	071027R01SB	071027R02SB	071027R03SB	071027R04SB	071027R05SB	071027R06SB
Sample Date	10/27/2007	10/27/2007	10/27/2007	10/27/2007	10/27/2007	10/27/2007
Percent Lipids	6.2	7	7.2	8.5	7.9	5.9
<b>PCB Aroclors (µg/kg wet)</b>						
Aroclor 1016	3.50 U	4.70 U	3.40 U	2.40 U	9.90 U	2.40 U
Aroclor 1221	4.70 U	2.60 U	2.60 U	2.60 U	20.0 U	2.60 U
Aroclor 1232	6.10 U	5.90 U	3.90 U	2.30 U	9.90 U	2.30 U
Aroclor 1242	4.50 UJ	6.30 UJ	2.20 UJ	2.20 UJ	<b>14.0 J</b>	<b>9.50 J</b>
Aroclor 1248	0.510 U	0.510 U	0.510 U	0.510 U	0.510 U	0.510 U
Aroclor 1254	<b>59.0 J</b>	<b>32.0 J</b>	<b>51.0 J</b>	9.60 UJ	<b>110 J</b>	<b>58.0 J</b>
Aroclor 1260	1.90 U	1.90 U	1.90 U	14.0 U	1.90 U	1.90 U
Aroclor 1262	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U
Aroclor 1268	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
Total PCBs as Aroclors (NDs at MDL) <sup>1</sup>	<b>63.5 J</b>	<b>38.3 J</b>	<b>53.2 J</b>	11.8 UJ	<b>124 J</b>	<b>67.5 J</b>
<b>PCB Congeners (µg/kg wet)</b>						
PCB 77	<b>0.0470</b>	<b>0.0358</b>	<b>0.0435</b>	<b>0.0254</b>	<b>0.195</b>	<b>0.0381</b>
PCB 81	0.00681 U	0.00574 U	0.00504 U	0.00547 U	0.0205 U	0.00944 U
PCB 105	<b>1.15</b>	<b>1.07</b>	<b>1.11</b>	<b>0.498</b>	<b>4.06</b>	<b>1.16</b>
PCB 114	<b>0.0770</b>	<b>0.0723</b>	<b>0.0652</b>	<b>0.0292</b>	<b>0.300</b>	0.0856 EMPC
PCB 118	<b>3.30</b>	<b>3.05</b>	<b>3.01</b>	<b>1.33</b>	<b>10.2</b>	<b>3.14</b>
PCB 123	<b>0.0554</b>	<b>0.0477</b>	0.0435 EMPC	<b>0.0248</b>	<b>0.184</b>	0.0470 EMPC
PCB 126	0.0112 U	0.0116 EMPC	0.0122 U	<b>0.00561</b>	0.0301 U	0.0157 U
PCB 156	<b>0.468 C</b>	<b>0.402 C</b>	<b>0.378 C</b>	<b>0.194 C</b>	<b>1.39 C</b>	<b>0.490 C</b>
PCB 157	PCB 156 and 157 are coeluting congeners and are represented with one concentration.					
PCB 167	<b>0.193</b>	<b>0.169</b>	<b>0.157</b>	<b>0.0843</b>	<b>0.536</b>	<b>0.181</b>
PCB 169	0.00551 U	0.00890 U	0.00536 U	0.00227 U	0.0109 U	0.00489 U
PCB 189	0.0165 EMPC	<b>0.0174</b>	0.0168 EMPC	<b>0.0133</b>	<b>0.0677</b>	0.0195 EMPC
Total PCBs as Congeners (KM, capped)	<b>47.9 J</b>	<b>41.8 J</b>	<b>44.7 J</b>	<b>22.1 J</b>	<b>164 J</b>	<b>44.4 J</b>
<b>Metals (mg/kg wet)</b>						
Aluminum	<b>0.802</b>	<b>1.55</b>	<b>1.13</b>	<b>0.330 J</b>	<b>0.663</b>	<b>2.11</b>
Antimony	0.00500 U	0.00500 U	0.00600 U	0.00600 U	0.00500 U	0.00500 U
Arsenic	<b>0.311</b>	<b>0.406</b>	<b>0.434</b>	<b>0.159</b>	<b>0.761</b>	<b>0.277 J</b>
Barium	<b>1.06</b>	<b>0.837</b>	<b>1.20</b>	<b>0.430</b>	<b>0.456</b>	<b>0.748</b>
Beryllium	0.000500 U	0.000500 U	0.000600 U	0.000600 U	0.000500 U	0.000500 U
Cadmium	<b>0.00800 J</b>	<b>0.00500 J</b>	<b>0.00600 J</b>	<b>0.00500 J</b>	<b>0.00400 J</b>	<b>0.00600 J</b>
Chromium	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U
Cobalt	0.0255 U	0.0309 U	0.0278 U	0.0248 U	0.0255 U	0.0267 U
Copper	<b>0.571</b>	<b>0.344</b>	<b>0.457</b>	<b>0.336</b>	<b>0.327</b>	<b>0.419</b>
Lead	0.0130 U	0.0140 U	0.0140 U	0.0150 U	0.0140 U	0.0130 U
Mercury	<b>0.106 J</b>	<b>0.217 J</b>	<b>0.0904 J</b>	<b>0.130 J</b>	<b>0.144 J</b>	<b>0.0548 J</b>
Methyl Mercury	-	-	-	-	-	-
Nickel	<b>0.324</b>	<b>0.399</b>	<b>0.328</b>	0.298 U	0.306 U	0.277 U
Thallium	<b>0.0159</b>	<b>0.0201</b>	<b>0.0205</b>	<b>0.0120</b>	<b>0.0189</b>	<b>0.0165</b>
Vanadium	<b>0.0400 J</b>	<b>0.0400 J</b>	<b>0.0400 J</b>	<b>0.0500 J</b>	<b>0.0300 J</b>	<b>0.0300 J</b>
Zinc	<b>13.4</b>	<b>13.9</b>	<b>12.9</b>	<b>13.4</b>	<b>11.2</b>	<b>14.6 J</b>
<b>Semivolatile Organic Compounds (µg/kg wet)</b>						
Bis(2-ethylhexyl) Phthalate	66.0 U	2,500 U	2,400 U	1,800 U	1,800 U	1,500 U
Butyl Benzyl Phthalate	7.30 U	7.30 U	7.30 U	7.30 U	7.30 U	7.30 U
Carbazole	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U
Di-n-butyl Phthalate	220 U	16.0 U	150 U	280 U	150 U	230 U
Di-n-octyl Phthalate	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U
p-cresol (4-Methylphenol)	7.70 U	7.70 U	7.70 U	7.70 U	7.70 U	7.70 UJ
<b>Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (µg/kg wet)</b>						
Acenaphthene	<b>0.700 J</b>	<b>0.770</b>	<b>1.00 J</b>	<b>0.560 J</b>	<b>0.820</b>	<b>0.570 J</b>
Anthracene	<b>0.0900 J</b>	0.650 U	<b>0.380 J</b>	0.0650 UJ	0.650 U	0.310 U
Fluorene	<b>1.00 J</b>	1.80 U	<b>1.40 J</b>	<b>1.50 J</b>	2.00 U	<b>0.890 J</b>
Phenanthrene	<b>2.50 J</b>	<b>3.70 J</b>	<b>3.00</b>	<b>3.10 J</b>	<b>4.60 J</b>	<b>2.20</b>
<b>High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (µg/kg wet)</b>						
Benzo(a)anthracene	0.0660 UJ	0.660 U	0.260 U	0.0660 UJ	0.660 U	0.140 U
Benzo(a)pyrene	0.0810 UJ	0.810 U	0.320 U	0.0810 UJ	0.810 U	0.170 U
Benzo(b)fluoranthene	0.0700 UJ	0.700 U	0.280 U	0.0700 UJ	0.700 U	0.140 U
Benzo(g,h,i)perylene	0.0730 UJ	0.730 U	0.290 U	0.0730 UJ	0.730 U	0.150 U
Benzo(k)fluoranthene	0.0560 UJ	0.560 U	0.220 U	0.0560 UJ	0.560 U	0.120 U
Chrysene	0.0760 UJ	0.760 U	0.300 U	0.0760 UJ	0.760 U	0.160 U
Dibenz(a,h)anthracene	0.0590 UJ	0.590 U	0.230 U	0.0590 UJ	0.590 U	0.120 U
Fluoranthene	0.0900 UJ	<b>1.90 J</b>	<b>1.40 J</b>	0.0900 UJ	<b>2.50 J</b>	1.20 U
Indeno(1,2,3-cd)pyrene	0.0640 UJ	0.640 U	0.250 U	0.0640 UJ	0.640 U	0.130 U
Pyrene	0.0980 UJ	0.980 U	<b>0.420 J</b>	0.0980 UJ	0.980 U	0.200 U

**Notes:**

µg/kg = microgram per kilogram

mg/kg = milligram per kilogram

MDL = method detection limit

RDL = reported detection limit

- = Not Analyzed

ND = Non Detect

**bold** = analyte detected above MDL/RDL.

J = The reported value is an estimate.

<sup>1</sup> Only Aroclor 1242 and 1254 were included in summing bass Total PCBs as Aroclors because all other aroclors were undected in Reference Area smallmouth bass samples.

KM, capped = Kaplan-Meier-based with Efron's bias correction, capped

U = The analyte was not detected at or above the MDL (except PCB congeners).

For PCB congeners, the analyte was not detected at or above the RDL/EMPC.

UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.

EMPC = The analyte was not positively identified; the associated

numerical value is the Estimated Maximum Potential Concentration.

**Table 6-6b**  
**Reference Area Smallmouth Bass Tissue Analytical Results**  
**PCB Aroclors, PCB Dioxin-Like Congeners, Metals, and Semivolatile Organic Compounds**  
**(Page 2 of 3)**

Area	Reference 26	Reference 27	Reference 28	Reference 29	Reference 30	Reference 31	Reference 32
Site ID	26	27	28	29	30	31	32
Sample ID	071115R07SB	080517R10SB	080517R11SB	080517R12SB	080517R13SB	080517R14SB	080521R15SB
Sample Date	11/15/2007	5/17/2008	5/17/2008	5/17/2008	5/17/2008	5/17/2008	5/21/2008
Percent Lipids	5.4	6.1	4.7	2.5	5.1	3.7	4.2
<b>PCB Aroclors (µg/kg wet)</b>							
Aroclor 1016	3.80 U	2.40 U	7.90 U	4.80 U	2.40 U	6.00 U	3.10 U
Aroclor 1221	3.80 U	2.60 U	18.0 U	2.60 U	2.60 U	20.0 U	2.60 U
Aroclor 1232	3.10 U	2.30 U	10.0 U	5.10 U	2.30 U	9.90 U	10.0 U
Aroclor 1242	2.20 UJ	<b>5.60 J</b>	10.0 UJ	2.20 UJ	<b>2.40 J</b>	2.20 UJ	2.20 UJ
Aroclor 1248	0.510 U	0.510 U	0.510 U	0.510 U	0.510 U	6.90 U	0.510 U
Aroclor 1254	<b>27.0 J</b>	<b>34.0 J</b>	<b>37.0 J</b>	<b>29.0 J</b>	<b>80.0 J</b>	17.0 UJ	<b>47.0 J</b>
Aroclor 1260	1.90 U	1.90 U	1.90 U	1.90 U	1.90 U	46.0 U	1.90 U
Aroclor 1262	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U	21.0 U	2.50 U
Aroclor 1268	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	3.40 U	2.00 U
Total PCBs as Aroclors (NDs at MDL) <sup>1</sup>	<b>29.2 J</b>	<b>39.6 J</b>	<b>47.0 J</b>	<b>31.2 J</b>	<b>82.4 J</b>	19.2 UJ	<b>49.2 J</b>
<b>PCB Congeners (µg/kg wet)</b>							
PCB 77	<b>0.0301</b>	<b>0.0754</b>	<b>0.0362</b>	<b>0.0436</b>	<b>0.0701</b>	<b>0.0548</b>	<b>0.0493</b>
PCB 81	0.00253 U	<b>0.00552</b>	<b>0.00256</b>	<b>0.00263</b>	<b>0.00326</b>	<b>0.00263</b>	<b>0.00235</b>
PCB 105	<b>1.01</b>	<b>3.50</b>	<b>0.940</b>	<b>1.00</b>	<b>1.91</b>	<b>1.37</b>	<b>1.31</b>
PCB 114	0.0684 EMPC	<b>0.272</b>	<b>0.0599</b>	<b>0.0802</b>	<b>0.123</b>	<b>0.145</b>	<b>0.0872</b>
PCB 118	<b>3.11</b>	<b>11.8</b>	<b>2.58</b>	<b>3.63</b>	<b>4.85</b>	<b>6.21</b>	<b>3.74</b>
PCB 123	<b>0.0531</b>	<b>0.148</b>	<b>0.0430</b>	<b>0.0553</b>	<b>0.0811</b>	<b>0.104</b>	<b>0.0606</b>
PCB 126	0.0107 U	<b>0.0259</b>	<b>0.00603</b>	<b>0.00955</b>	<b>0.0126</b>	<b>0.0143</b>	<b>0.00945</b>
PCB 156	<b>0.448 C</b>	<b>1.89 C</b>	<b>0.290 C</b>	<b>0.430 C</b>	<b>0.638 C</b>	<b>0.882 C</b>	<b>0.447 C</b>
PCB 156 and 157 are coeluting congeners and are represented with one concentration.							
PCB 167	<b>0.168</b>	<b>0.571</b>	<b>0.117</b>	<b>0.211</b>	<b>0.242</b>	<b>0.380</b>	<b>0.180</b>
PCB 169	0.00857 U	0.00812 U	0.00130 U	0.00186 U	0.00279 U	0.00307 U	0.00154 U
PCB 189	0.0232 EMPC	<b>0.102</b>	<b>0.0147</b>	<b>0.0217</b>	<b>0.0313</b>	<b>0.0444</b>	<b>0.0197</b>
Total PCBs as Congeners (KM, capped)	<b>41.7 J</b>	<b>117 J</b>	<b>35.8 J</b>	<b>39.8 J</b>	<b>69.0 J</b>	<b>50.2 J</b>	<b>43.1 J</b>
<b>Metals (mg/kg wet)</b>							
Aluminum	<b>1.55</b>	<b>1.52</b>	<b>3.86</b>	<b>10.1</b>	<b>2.44</b>	<b>0.970</b>	<b>5.41</b>
Antimony	0.00600 U	<b>0.0250</b>	<b>0.00300 J</b>	<b>0.00300 J</b>	0.00200 U	<b>0.00300 J</b>	0.00200 U
Arsenic	<b>0.270</b>	<b>0.640</b>	<b>0.240</b>	<b>0.420</b>	<b>0.290</b>	<b>0.430</b>	<b>0.230</b>
Barium	<b>1.50</b>	<b>0.915</b>	<b>0.875</b>	<b>1.72</b>	<b>0.871</b>	<b>1.65</b>	<b>1.11</b>
Beryllium	0.000600 U	0.00200 U	0.00200 U	0.00200 U	0.00200 U	0.00200 U	0.00200 U
Cadmium	<b>0.00400 J</b>	<b>0.143</b>	<b>0.130</b>	<b>0.111</b>	<b>0.140</b>	<b>0.125</b>	<b>0.111</b>
Chromium	0.100 U	<b>7.15</b>	<b>0.210 J</b>	<b>0.160 J</b>	<b>0.0900 J</b>	<b>0.0900 J</b>	<b>0.0700 J</b>
Cobalt	0.0361 U	<b>0.0838</b>	<b>0.0576</b>	<b>0.0602</b>	<b>0.0487</b>	<b>0.0551</b>	<b>0.0748</b>
Copper	<b>0.575</b>	<b>0.680</b>	<b>0.490</b>	<b>0.500</b>	<b>0.700</b>	<b>0.440</b>	<b>0.690</b>
Lead	0.0140 U	<b>1.81</b>	<b>1.70</b>	<b>1.43</b>	<b>1.69</b>	<b>1.47</b>	<b>1.47</b>
Mercury	<b>0.0932 J</b>	<b>0.333 J</b>	<b>0.0630 J</b>	<b>0.102 J</b>	<b>0.141 J</b>	<b>0.233 J</b>	<b>0.0600 J</b>
Methyl Mercury	-	-	-	-	-	-	-
Nickel	<b>0.408</b>	<b>1.48</b>	<b>1.38</b>	<b>1.34</b>	<b>1.18</b>	<b>1.31</b>	<b>1.29</b>
Thallium	<b>0.0149</b>	<b>0.0261</b>	<b>0.0152</b>	<b>0.0149</b>	<b>0.0123</b>	<b>0.0152</b>	<b>0.0118</b>
Vanadium	<b>0.0600</b>	0.00600 U	<b>0.0510 J</b>	<b>0.102</b>	<b>0.0480 J</b>	<b>0.0710</b>	<b>0.0730</b>
Zinc	<b>12.9</b>	<b>15.1</b>	<b>14.8</b>	<b>13.1</b>	<b>12.8</b>	<b>13.0</b>	<b>11.5</b>
<b>Semivolatile Organic Compounds (µg/kg wet)</b>							
Bis(2-ethylhexyl) Phthalate	1,700 U	66.0 U	<b>150 J</b>	66.0 U	66.0 U	66.0 U	66.0 U
Butyl Benzyl Phthalate	7.30 U	7.30 U	7.30 U	7.30 U	7.30 U	7.30 U	7.30 U
Carbazole	9.10 U	7.70 U	7.70 U	7.70 U	7.70 U	7.70 U	7.70 U
Di-n-butyl Phthalate	87.0 U	100 U	100 U	100 U	100 U	100 U	100 U
Di-n-octyl Phthalate	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U
p-cresol (4-Methylphenol)	7.70 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U
<b>Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (µg/kg wet)</b>							
Acenaphthene	<b>1.00 J</b>	<b>0.970</b>	<b>0.810</b>	0.110 U	<b>0.980</b>	<b>0.510</b>	<b>0.900</b>
Anthracene	<b>0.220 J</b>	0.0650 U	0.0650 U	0.0650 U	0.0650 U	0.0650 U	0.0650 U
Fluorene	<b>1.30 J</b>	<b>1.50</b>	<b>1.20</b>	0.150 U	<b>1.60</b>	<b>0.920</b>	<b>1.60</b>
Phenanthrene	<b>2.40</b>	<b>2.10</b>	<b>2.40</b>	<b>1.40</b>	<b>2.40</b>	<b>2.00</b>	<b>4.70</b>
<b>High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (µg/kg wet)</b>							
Benzo(a)anthracene	0.190 U	<b>0.940</b>	<b>0.560</b>	0.0660 U	0.0660 U	0.0660 U	0.0660 U
Benzo(a)pyrene	0.230 U	0.0810 U	0.0810 U	0.0810 U	0.0810 U	0.0810 U	0.0810 U
Benzo(b)fluoranthene	0.200 U	0.0700 U	0.0700 U	0.0700 U	0.0700 U	0.0700 U	0.0700 U
Benzo(g,h,i)perylene	0.200 U	0.0730 U	0.0730 U	0.0730 U	0.0730 U	0.0730 U	0.0730 U
Benzo(k)fluoranthene	0.160 U	0.0560 U	0.0560 U	0.0560 U	0.0560 U	0.0560 U	0.0560 U
Chrysene	0.210 U	<b>0.550</b>	0.0760 U	0.0760 U	0.0760 U	0.0760 U	0.0760 U
Dibenz(a,h)anthracene	0.170 U	0.0590 U	0.0590 U	0.0590 U	0.0590 U	0.0590 U	0.0590 U
Fluoranthene	<b>0.690 J</b>	0.0900 U	0.0900 U	0.0900 U	0.0900 U	0.0900 U	<b>1.40</b>
Indeno(1,2,3-cd)pyrene	0.180 U	0.0640 U	0.0640 U	0.0640 U	0.0640 U	0.0640 U	0.0640 U
Pyrene	<b>0.380 J</b>	0.0980 U	0.0980 U	0.0980 U	0.0980 U	0.0980 U	0.0980 U

**Notes:**

µg/kg = microgram per kilogram

mg/kg = milligram per kilogram

MDL = method detection limit

RDL = reported detection limit

- = Not Analyzed

ND = Non Detect

**bold** = analyte detected above MDL/RDL.

J = The reported value is an estimate

**Table 6-6b**  
**Reference Area Smallmouth Bass Tissue Analytical Results**  
**PCB Aroclors, PCB Dioxin-Like Congeners, Metals, and Semivolatile Organic Compounds**  
**(Page 3 of 3)**

Area	Reference	Reference	Reference	Reference	Reference	Reference
Site ID	33	34	35	36	37	38
Sample ID	080521R16SB	080521R17SB	080521R18SB	080521R19SB	080521R20SB	080521R21SB
Sample Date	5/21/2008	5/21/2008	5/21/2008	5/21/2008	5/21/2008	5/21/2008
Percent Lipids	2.6	4.1	4.2	5.3	4.1	2.8
<b>PCB Aroclors (µg/kg wet)</b>						
Aroclor 1016	5.90 U	5.20 U	4.50 U	5.40 U	7.30 U	4.50 U
Aroclor 1221	6.90 U	5.90 U	7.40 U	20.0 U	12.0 U	3.70 U
Aroclor 1232	5.70 U	3.90 U	4.40 U	5.40 U	10.0 U	11.0 U
Aroclor 1242	2.20 UJ	2.90 UJ	10.0 UJ	2.20 UJ	10.0 UJ	3.80 UJ
Aroclor 1248	33.0 U	0.510 U	0.510 U	0.510 U	0.510 U	0.510 U
Aroclor 1254	130 UJ	<b>47.0 J</b>	<b>46.0 J</b>	<b>85.0 J</b>	<b>37.0 J</b>	<b>58.0 J</b>
Aroclor 1260	140 U	1.90 U	1.90 U	1.90 U	1.90 U	1.90 U
Aroclor 1262	110 U	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U
Aroclor 1268	10.0 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
Total PCBs as Aroclors (NDs at MDL) <sup>1</sup>	132 UJ	<b>49.9 J</b>	<b>56.0 J</b>	<b>87.2 J</b>	<b>47.0 J</b>	<b>58.0 J</b>
<b>PCB Congeners (µg/kg wet)</b>						
PCB 77	<b>0.172</b>	<b>0.0537</b>	<b>0.0597</b>	<b>0.0701</b>	<b>0.0528</b>	<b>0.0497</b>
PCB 81	<b>0.0159</b>	<b>0.00340</b>	<b>0.00406</b>	<b>0.00376</b>	<b>0.00202</b>	<b>0.00311</b>
PCB 105	<b>23.4</b>	<b>1.32</b>	<b>2.00</b>	<b>2.09</b>	<b>1.44</b>	<b>1.68</b>
PCB 114	<b>2.91</b>	<b>0.0826</b>	<b>0.132</b>	<b>0.137</b>	<b>0.0971</b>	<b>0.106</b>
PCB 118	<b>98.6</b>	<b>3.65</b>	<b>5.97</b>	<b>5.35</b>	<b>4.78</b>	<b>4.46</b>
PCB 123	<b>1.83</b>	<b>0.0648</b>	<b>0.0840</b>	<b>0.0802</b>	<b>0.0761</b>	<b>0.0691</b>
PCB 126	<b>0.0746</b>	<b>0.00901</b>	<b>0.0134</b>	<b>0.0129</b>	<b>0.0107</b>	<b>0.00865</b>
PCB 156	<b>20.0 C</b>	<b>0.420 C</b>	<b>0.786 C</b>	<b>0.714 C</b>	<b>0.557 C</b>	<b>0.544 C</b>
PCB 157	PCB 156 and 157 are coeluting congeners and are represented with one concentration.					
PCB 167	<b>6.54</b>	<b>0.175</b>	<b>0.286</b>	<b>0.242</b>	<b>0.276</b>	<b>0.198</b>
PCB 169	0.00662 U	0.00216 U	0.00482 U	0.00596 U	0.00356 U	0.00210 U
PCB 189	<b>0.532</b>	<b>0.0209</b>	<b>0.0386</b>	<b>0.0375</b>	<b>0.0295</b>	<b>0.0205</b>
Total PCBs as Congeners (KM, capped)	<b>499 J</b>	<b>44.2 J</b>	<b>60.6 J</b>	<b>77.9 J</b>	<b>52.9 J</b>	<b>52.8 J</b>
<b>Metals (mg/kg wet)</b>						
Aluminum	<b>1.13</b>	<b>3.02</b>	<b>0.680</b>	<b>4.01</b>	<b>3.95</b>	<b>2.28</b>
Antimony	0.00200 U	0.00200 U	0.00200 U	0.00200 U	0.00200 U	0.00200 U
Arsenic	<b>0.180</b>	<b>0.240</b>	<b>0.290</b>	<b>0.320</b>	<b>0.440</b>	<b>0.390</b>
Barium	<b>1.42</b>	<b>1.22</b>	<b>0.843</b>	<b>0.957</b>	<b>1.36</b>	<b>1.70</b>
Beryllium	0.00200 U	0.00200 U	0.00200 U	0.00200 U	0.00200 U	0.00200 U
Cadmium	<b>0.138</b>	<b>0.126</b>	<b>0.117</b>	<b>0.124</b>	<b>0.129</b>	<b>0.112</b>
Chromium	<b>0.130 J</b>	<b>0.0600 J</b>	<b>0.0600 J</b>	<b>0.0400 J</b>	<b>0.0700 J</b>	<b>0.0800 J</b>
Cobalt	<b>0.0704</b>	<b>0.0601</b>	<b>0.0552</b>	<b>0.0523</b>	<b>0.0536</b>	<b>0.0574</b>
Copper	<b>0.630</b>	<b>0.590</b>	<b>0.410</b>	<b>0.370</b>	<b>0.730</b>	<b>0.430</b>
Lead	<b>1.66</b>	<b>1.65</b>	<b>1.53</b>	<b>1.62</b>	<b>1.59</b>	<b>1.42</b>
Mercury	<b>0.123 J</b>	<b>0.0650 J</b>	<b>0.178 J</b>	<b>0.105 J</b>	<b>0.176 J</b>	<b>0.0730 J</b>
Methyl Mercury	-	-	-	-	-	-
Nickel	<b>1.79</b>	<b>1.38</b>	<b>1.29</b>	<b>1.23</b>	<b>1.18</b>	<b>1.33</b>
Thallium	<b>0.0113</b>	<b>0.0139</b>	<b>0.0109</b>	<b>0.0133</b>	<b>0.0218</b>	<b>0.0180</b>
Vanadium	<b>0.104</b>	<b>0.0510 J</b>	<b>0.0600</b>	<b>0.0800</b>	<b>0.0660</b>	<b>0.0570</b>
Zinc	<b>12.8</b>	<b>12.7</b>	<b>12.3</b>	<b>14.3</b>	<b>14.8</b>	<b>15.5</b>
<b>Semivolatile Organic Compounds (µg/kg wet)</b>						
Bis(2-ethylhexyl) Phthalate	66.0 U	66.0 U	66.0 U	66.0 U	<b>81.0 J</b>	66.0 U
Butyl Benzyl Phthalate	7.30 U	7.30 U	7.30 U	7.30 U	7.30 U	7.30 U
Carbazole	7.70 U	7.70 U	7.70 U	7.70 U	7.70 U	7.70 U
Di-n-butyl Phthalate	100 U	100 U	100 U	100 U	100 U	100 U
Di-n-octyl Phthalate	<b>15.0 J</b>	11.0 U				
p-cresol (4-Methylphenol)	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U
<b>Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) (µg/kg wet)</b>						
Acenaphthene	<b>0.540</b>	<b>0.870</b>	<b>0.990</b>	<b>1.30</b>	<b>0.800</b>	<b>0.540</b>
Anthracene	0.0650 U	0.0650 U	0.0650 U	0.0650 U	0.0650 U	0.0650 U
Fluorene	<b>0.940</b>	<b>1.40</b>	<b>1.70</b>	<b>2.10</b>	<b>1.50</b>	<b>0.990</b>
Phenanthrene	<b>3.70</b>	<b>3.80</b>	<b>4.10</b>	<b>5.10</b>	<b>2.30</b>	<b>3.60</b>
<b>High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) (µg/kg wet)</b>						
Benzo(a)anthracene	0.0660 U	0.0660 U	0.0660 U	0.0660 U	<b>0.610</b>	0.0660 U
Benzo(a)pyrene	0.0810 U	0.0810 U	0.0810 U	0.0810 U	0.0810 U	0.0810 U
Benzo(b)fluoranthene	0.0700 U	0.0700 U	0.0700 U	0.0700 U	0.0700 U	0.0700 U
Benzo(g,h,i)perylene	0.0730 U	0.0730 U	0.0730 U	0.0730 U	0.0730 U	0.0730 U
Benzo(k)fluoranthene	0.0560 U	0.0560 U	0.0560 U	0.0560 U	0.0560 U	0.0560 U
Chrysene	0.0760 U	0.0760 U	0.0760 U	0.0760 U	0.0760 U	0.0760 U
Dibenz(a,h)anthracene	0.0590 U	0.0590 U	0.0590 U	0.0590 U	0.0590 U	0.0590 U
Fluoranthene	<b>1.20</b>	<b>1.00</b>	<b>1.10</b>	<b>1.60</b>	<b>0.750</b>	<b>0.780</b>
Indeno(1,2,3-cd)pyrene	0.0640 U	0.0640 U	0.0640 U	0.0640 U	0.0640 U	0.0640 U
Pyrene	0.0980 U	0.0980 U	0.0980 U	0.0980 U	0.0980 U	0.0980 U

**Notes:**

µg/kg = microgram per kilogram

mg/kg = milligram per kilogram

MDL = method detection limit

RDL = reported detection limit

- = Not Analyzed

ND = Non Detect

**bold** = analyte detected above MDL/RDL.

J = The reported value is an estimate.

<sup>1</sup> Only Aroclor 1242 and 1254 were included in summing bass Total PCBs as Aroclors because all other aroclors were undected in Reference Area smallmouth bass samples.

KM, capped = Kaplan-Meier-based with Efron's bias correction, capped

U = The analyte was not detected at or above the MDL (except PCB congeners).

For PCB congeners, the analyte was not detected at or above the RDL/EMPC.

UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.

EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.

**Table 1**  
**Reference Area Smallmouth Bass - Analytical Results and Screening Criteria for PCB Aroclors, Metals, PAHs, Pesticides, Butyltins, and SVOCs**

Area	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Selected SLV	SLV Source
Site ID	39	41	42	43	44	45	46	47	48	49	50			
Sample ID	R08202011SB39	R08202011SB41	R08202011SB42	R08202011SB43	R08202011SB44	R08202011SB45	R08202011SB46	R08202011SB47	R08202011SB48	R08202011SB49	R08202011SB50			
Sample Date	8/20/2011	8/20/2011	8/20/2011	8/20/2011	8/20/2011	8/20/2011	8/20/2011	8/20/2011	8/20/2011	8/20/2011	8/20/2011			
Percent Lipids	2.9	1.7	2.6	4.2	4.0	2.2	0.89	3.9	4.3	4.1	1.7			
<b>PCB Aroclors (µg/kg wet)</b>														
Aroclor 1016	2.80 U	2.80 U	2.80 U	2.80 U	3.10 U	3.00 U	2.80 U	2.90 U	5.00 U	2.80 U	3.40 U	0.570	HH	
Aroclor 1221	9.70 U	3.50 U	6.70 U	2.80 U	7.00 U	17.0 U	4.80 U	7.00 U	6.50 U	2.80 U	5.00 U	0.570	HH	
Aroclor 1232	9.10 U	2.80 U	2.80 U	2.80 U	4.90 U	10.0 U	3.80 U	2.80 U	6.90 U	2.80 U	2.80 U	0.570	HH	
Aroclor 1242	2.80 U	3.20 U	3.40 U	2.80 U	2.80 U	2.80 U	2.80 U	2.80 U	9.30 U	2.80 U	3.30 U	0.570	HH	
Aroclor 1248	2.80 U	6.60 U	5.40 U	2.80 U	9.40 U	2.80 U	4.20 U	3.60 U	6.30 U	2.80 U	5.40 U	0.570	HH	
Aroclor 1254	12.0 U	42.0 U	29.0 U	36.0	20.0 U	18.0 U	12.0 U	18.0 U	21.0 U	220	21.0 U	0.570	HH	
Aroclor 1260	8.00 U	37.0 U	20.0 U	2.80 U	11.0 U	14.0 U	13.0 U	12.0 U	18.0 U	2.80 U	23.0 U	0.570	HH	
Aroclor 1262	2.80 U	2.80 U	2.80 U	2.80 U	2.80 U	2.80 U	2.80 U	2.80 U	2.80 U	2.80 U	2.80 U	0.570	HH	
Aroclor 1268	2.80 U	2.80 U	2.80 U	2.80 U	2.80 U	2.80 U	2.80 U	2.80 U	2.80 U	2.80 U	2.80 U	0.570	HH	
Total PCBs as Aroclors	12.0 U	42.0 U	29.0 U	36.0	20.0 U	18.0 U	13.0 U	18.0 U	21.0 U	220	23.0 U	0.570	HH	
<b>Metals (mg/kg wet)</b>														
Aluminum	<b>1.25</b>	2.71 U	<b>5.29</b>	0.580 U	0.560 U	<b>11.3</b>	<b>3.02</b>	<b>9.24</b>	<b>1.34</b>	<b>5.39</b>	<b>1.48</b>	--	--	
Antimony	<b>0.00330 J</b>	0.0132 U	<b>0.0076 J</b>	0.0141 U	0.0141 U	0.0129 U	0.0131 U	0.0144 U	0.0146 U	0.0159 U	0.1290 U	--	--	
Arsenic	<b>0.383</b>	<b>0.264</b>	<b>0.390</b>	<b>0.403</b>	<b>0.501</b>	<b>0.457</b>	<b>0.348</b>	<b>0.728</b>	<b>0.664</b>	<b>0.484</b>	<b>0.409</b>	0.000760	HH	
Barium	<b>1.74</b>	<b>1.78</b>	<b>1.63</b>	<b>0.778</b>	<b>0.934</b>	<b>3.13</b>	<b>2.29</b>	<b>3.42</b>	<b>1.55</b>	<b>1.77</b>	<b>1.11</b>	--	--	
Beryllium	0.000800 U	0.000800 U	0.000900 U	0.000800 U	0.000800 U	0.000800 U	0.000800 U	0.000900 U	0.000900 U	0.00100 U	0.000800 U	--	--	
Cadmium	<b>0.00570</b>	<b>0.0108</b>	<b>0.00940</b>	<b>0.00840</b>	<b>0.00390 J</b>	<b>0.0101</b>	<b>0.00670</b>	<b>0.00940</b>	<b>0.00710</b>	<b>0.0107</b>	<b>0.0105</b>	0.150	Eco	
Chromium	0.0200 U	<b>0.0500 J</b>	0.170	0.0300 U	0.0300 U	0.130	0.400	0.100	0.0300 U	0.0700	<b>0.0800</b>	--	--	
Cobalt	<b>0.00700</b>	<b>0.0120</b>	<b>0.0140</b>	<b>0.00900</b>	<b>0.00800</b>	<b>0.0160</b>	<b>0.0170</b>	<b>0.00700</b>	<b>0.0100</b>	<b>0.00700</b>	--	--	--	
Copper	<b>0.438</b>	<b>0.476</b>	<b>0.618</b>	<b>0.457</b>	<b>0.250 U</b>	<b>0.543</b>	<b>0.454</b>	<b>0.488</b>	<b>0.388</b>	<b>0.729</b>	<b>0.503</b>	--	--	
Lead	0.00710 U	<b>0.150</b>	0.0116 U	0.00560 U	0.00560 U	0.0169 U	0.00930 U	0.0165 U	0.0141 U	0.00640 U	0.0206 U	0.120	Eco	
Mercury	<b>0.0659</b>	<b>0.176 J</b>	<b>0.142</b>	<b>0.527</b>	<b>0.0828</b>	<b>0.0445</b>	<b>0.362</b>	<b>0.0446</b>	<b>0.184</b>	<b>0.127</b>	<b>0.635</b>	0.0490	HH	
Nickel	<b>0.0540</b>	<b>0.0570</b>	<b>0.102</b>	<b>0.0460 J</b>	<b>0.0560 U</b>	<b>0.0550 U</b>	<b>0.200</b>	<b>0.100</b>	<b>0.0580 U</b>	<b>0.0640 U</b>	<b>0.0630</b>	--	--	
Thallium	<b>0.0153</b>	<b>0.00830</b>	<b>0.0109</b>	<b>0.00880</b>	<b>0.0183</b>	<b>0.0286</b>	<b>0.00880</b>	<b>0.0268</b>	<b>0.0160</b>	<b>0.0120</b>	<b>0.00750</b>	--	--	
Vanadium	<b>0.0240 J</b>	<b>0.0200 J</b>	<b>0.0540 J</b>	<b>0.0360 J</b>	<b>0.0180 J</b>	<b>0.0810</b>	<b>0.0750</b>	<b>0.0860</b>	<b>0.0380 J</b>	<b>0.0550 J</b>	<b>0.0210 J</b>	--	--	
Zinc	<b>14.0</b>	<b>11.5</b>	<b>13.9</b>	<b>13.1</b>	<b>13.6</b>	<b>15.5</b>	<b>14.2</b>	<b>16.3</b>	<b>12.3</b>	<b>13.4</b>	<b>15.0</b>	--	--	
<b>Butyltins (µg/kg wet)</b>														
Dibutyltin Cation	-	0.110 U	0.110 U	0.110 U	0.110 U	-	0.110 U	<b>3.00</b>	0.110 U	0.110 U	0.110 UJ	--	--	
Monobutyltin	-	0.180 U	0.180 U	0.180 U	0.180 U	-	0.180 U	0.700 U	0.180 U	0.180 U	0.180 UJ	--	--	
Tetrabutyltin	-	0.150 U	0.150 U	0.150 UJ	0.150 U	-	0.150 U	0.150 U	0.150 U	0.150 U	0.150 UJ	--	--	
Tri-n-butyltin	-	0.110 U	4.10 U	0.110 U	0.110 U	-	0.110 U	1.10 U	0.110 U	0.110 U	0.110 UJ	150	ATLs	
<b>Pesticides (µg/kg wet)</b>														
4,4'-DDD	<b>3.50</b>	<b>4.70</b>	<b>8.90</b>	<b>9.60</b>	<b>4.80</b>	<b>3.90</b>	<b>1.90</b>	<b>6.80</b>	<b>6.90</b>	<b>8.20</b>	<b>5.40</b>	--	--	
4,4'-DDE	<b>39.0</b>	<b>79.0</b>	<b>87.0</b>	<b>85.0</b>	<b>60.0</b>	<b>57.0</b>	<b>33.0</b>	<b>87.0</b>	<b>82.0</b>	<b>89.0</b>	<b>62.0 J</b>	--	--	
4,4'-DDT	<b>3.80 J</b>	9.20 U	<b>6.70 J</b>	9.80 U	<b>4.50 J</b>	<b>3.10 J</b>	<b>3.20 J</b>	4.70 U	<b>6.00 J</b>	<b>17.0 J</b>	<b>6.80 J</b>	3.40	ATLs	
Aldrin	0.740 U	0.740 U	0.740 U	0.740 U	0.740 U	0.740 U	0.740 U	0.740 U	0.740 U	0.740 U	0.740 U	--	--	
BHC (alpha)	0.160 U	0.220 U	0.160 U	0.220 U	0.170 U	0.160 U	0.160 U	0.160 U	0.160 U	0.160 U	0.160 U	--	--	
BHC (beta)	<b>0.620 J</b>	<b>0.520 J</b>	<b>0.540 U</b>	<b>3.60</b>	<b>2.30</b>	<b>3.60</b>	<b>0.700 J</b>	2.00 U	<b>3.90</b>	4.10 U	<b>2.50</b>	--	--	
BHC (delta)	0.200 U	0.200 U	0.200 U	0.970 U	0.260 U	0.200 U	0.200 U	0.200 U	0.930 U	1.40 U	0.930 U	--	--	
BHC (gamma) Lindane	0.210 U	0.900 U	<b>1.00</b>	1.40 U	0.940 U	1.00 U	0.280 U	<b>0.540 J</b>	<b>0.340 J</b>	1.30 U	1.10 U	<b>0.940</b>	--	
Chlordane (alpha)	0.250 U	0.250 U	0.250 U	0.250 U	0.250 U	0.250 U	0.250 U	0.250 U	0.250 U	0.310 J	0.920 U	0.250 U	3.30 ATLS	
Chlordane (gamma)	0.260 U	1.20 U	0.260 U	1.50	0.310 J	0.370 J	0.260 U	<b>0.290 J</b>	<b>0.630 J</b>	<b>4.20</b>	<			



**Table 2**  
Forebay Smallmouth Bass - Analytical Results and Screening Criteria for PCB Aroclors, Metals, PAHs, Pesticides, Butyltins, and SVOCs

Area	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	Selected SLV	SLV Source
Site ID	62	63	64	65	67	68	69	70	71	72			
Sample ID	R09032011SB62	R09032011SB63	R09032011SB64	R09032011SB65	R09032011SB67	R09032011SB68	R09032011SB69	R09032011SB70	R09042011SB71	R09042011SB72			
Sample Date	9/3/2011	9/3/2011	9/3/2011	9/3/2011	9/3/2011	9/3/2011	9/3/2011	9/3/2011	9/3/2011	9/4/2011	9/4/2011		
Percent Lipids	4.2	3.4	1.9	3.4	3.6	3.1	2.5	3.1	3.4	2.1			
<b>PCB Aroclors (µg/kg wet)</b>													
Aroclor 1016	280 U	280 U	2.80 U	2.80 U	2.80 U	280 U	2.80 U	2.80 U	2.80 U	2.80 U	2.80 U	0.570	HH
Aroclor 1221	280 U	280 U	2.80 U	2.80 U	2.80 U	280 U	2.80 U	2.80 U	2.80 U	2.80 U	2.80 U	0.570	HH
Aroclor 1232	280 U	280 U	2.80 U	2.80 U	2.80 U	280 U	2.80 U	2.80 U	2.80 U	2.80 U	2.80 U	0.570	HH
Aroclor 1242	280 U	280 U	2.80 U	2.80 U	2.80 U	280 U	2.80 U	2.80 U	2.80 U	2.80 U	2.80 U	0.570	HH
Aroclor 1248	280 U	280 U	2.80 U	2.80 U	2.80 U	280 U	2.80 U	2.80 U	2.80 U	2.80 U	2.80 U	0.570	HH
Aroclor 1254	<b>13,000</b>	<b>29,000</b>	<b>32.0</b>	<b>20.0</b>	<b>21.0</b>	<b>65,000</b>	<b>37.0</b>	<b>17.0</b>	<b>26.0</b>	<b>5.80 U</b>	<b>0.570</b>	<b>HH</b>	
Aroclor 1260	280 U	280 U	2.80 U	2.80 U	2.80 U	280 U	2.80 U	2.80 U	2.80 U	2.80 U	2.80 U	0.570	HH
Aroclor 1262	280 U	280 U	2.80 U	2.80 U	2.80 U	280 U	2.80 U	2.80 U	2.80 U	2.80 U	2.80 U	0.570	HH
Aroclor 1268	280 U	280 U	2.80 U	2.80 U	2.80 U	280 U	2.80 U	2.80 U	2.80 U	2.80 U	2.80 U	0.570	HH
Total PCBs as Aroclors (NDs at MDL) <sup>1</sup>	<b>13,000</b>	<b>29,000</b>	<b>32.0</b>	<b>20.0</b>	<b>21.0</b>	<b>65,000</b>	<b>37.0</b>	<b>17.0</b>	<b>26.0</b>	<b>5.80 U</b>	<b>0.570</b>	<b>HH</b>	
<b>Metals (mg/kg wet)</b>													
Aluminum	<b>1.52</b>	<b>4.54</b>	<b>4.47</b>	<b>3.03</b>	<b>3.13</b>	<b>0.490 J</b>	<b>4.57</b>	<b>9.52</b>	<b>2.97</b>	<b>6.36</b>	--	--	
Antimony	<b>0.00370 J</b>	<b>0.0107 J</b>	<b>0.00660 J</b>	<b>0.00810 J</b>	<b>0.0132</b>	<b>0.0107 J</b>	<b>0.00310 J</b>	<b>0.00900 J</b>	<b>0.0258</b>	<b>0.00800 J</b>	--	--	
Arsenic	<b>0.388</b>	<b>0.314</b>	<b>0.530</b>	<b>0.432</b>	<b>0.345</b>	<b>0.341</b>	<b>0.314</b>	<b>0.302</b>	<b>0.385</b>	<b>0.410</b>	<b>0.000760</b>	<b>HH</b>	
Barium	<b>1.95</b>	<b>3.07</b>	<b>2.46</b>	<b>3.60</b>	<b>2.40</b>	<b>1.33</b>	<b>3.01</b>	<b>3.38</b>	<b>2.82</b>	<b>6.40</b>	--	--	
Beryllium	0.000900 U	0.000700 U	0.000700 U	0.000700 U	0.000700 U	0.000800 U	0.000600 U	0.000700 U	0.000800 U	0.000700 U	--	--	
Cadmium	<b>0.00560 J</b>	<b>0.0122</b>	<b>0.00970</b>	<b>0.0118</b>	<b>0.0143</b>	<b>0.00550</b>	<b>0.00850</b>	<b>0.00940</b>	<b>0.00810</b>	<b>0.0183</b>	<b>0.150</b>	<b>Eco</b>	
Chromium	<b>0.0500 J</b>	<b>0.0400 J</b>	<b>0.0900</b>	<b>0.110</b>	<b>0.0700</b>	<b>0.0200 U</b>	<b>0.0200 J</b>	<b>0.0600</b>	<b>0.760</b>	<b>0.290</b>	--	--	
Cobalt	0.00800	0.0110	0.0110	0.0120	0.00800	0.00600	0.0110	0.0210	0.0140	0.0130	--	--	
Copper	<b>0.656</b>	<b>1.24</b>	<b>0.616</b>	<b>0.925</b>	<b>1.01</b>	<b>0.415</b>	<b>0.663</b>	<b>1.18</b>	<b>0.739</b>	<b>1.76</b>	--	--	
Lead	<b>0.0185</b>	<b>0.0139 U</b>	<b>0.00770 U</b>	<b>0.0136 U</b>	<b>0.0111 U</b>	<b>0.00820 U</b>	<b>0.00980 U</b>	<b>0.0103 U</b>	<b>0.00580 U</b>	<b>0.00960 U</b>	<b>0.120</b>	<b>Eco</b>	
Mercury	<b>0.452</b>	<b>0.118</b>	<b>0.0662</b>	<b>0.128</b>	<b>0.122</b>	<b>0.155</b>	<b>0.0599</b>	<b>0.111</b>	<b>0.131</b>	<b>0.0899</b>	<b>0.0490</b>	<b>HH</b>	
Nickel	<b>0.0480 J</b>	<b>0.0620</b>	<b>0.0830</b>	<b>0.0660</b>	<b>0.0470 J</b>	<b>0.0510</b>	<b>0.0600</b>	<b>0.0870</b>	<b>0.344</b>	<b>0.0900</b>	--	--	
Thallium	0.00800	0.0131	0.0198	0.0122	0.0127	0.0121	0.0114	0.0110	0.0118	0.0122	--	--	
Vanadium	<b>0.0380 J</b>	<b>0.0360 J</b>	<b>0.0630</b>	<b>0.0490</b>	<b>0.0600</b>	<b>0.0310 J</b>	<b>0.0570</b>	<b>0.0780</b>	<b>0.0530 J</b>	<b>0.0710</b>	--	--	
Zinc	<b>15.0</b>	<b>15.2</b>	<b>13.3</b>	<b>13.9</b>	<b>12.6</b>	<b>13.3</b>	<b>11.4</b>	<b>12.9</b>	<b>11.6</b>	<b>12.7</b>	--	--	
<b>Butyltins (µg/kg wet)</b>													
Dibutyltin Cation	0.110 U	-	-	-	-	0.110 U	-	0.110 U	0.110 U	-	-	--	
Monobutyltin	0.180 U	-	-	-	-	0.180 U	-	0.180 U	0.180 U	-	-	--	
Tetrabutyltin	0.150 U	-	-	-	-	0.150 U	-	0.150 U	0.150 U	-	-	--	
Tri-n-butyltin	0.110 U	-	-	-	-	0.110 U	-	0.110 U	0.110 U	-	150	ATLs	
<b>Pesticides (µg/kg wet)</b>													
4,4'-DDD	20.0 U	2.70 U	<b>2.80</b>	<b>3.10</b>	<b>2.50</b>	<b>4.80</b>	<b>1.70</b>	<b>2.10</b>	<b>3.40</b>	<b>1.30</b>	--	--	
4,4'-DDE	200 U	34.0 U	<b>29.0</b>	<b>25.0</b>	<b>20.0</b>	35.0 U	<b>13.0</b>	<b>18.0</b>	<b>23.0</b>	<b>14.0</b>	--	--	
4,4'-DDT	2,300 U	6,800 U	4.70 U	1.00 U	<b>3.10 J</b>	16,000 U	<b>4.90 J</b>	2.10 U	<b>4.50 J</b>	1.10 U	3.40	ATLs	
Aldrin	0.740 U	0.740 U	0.740 U	0.740 U	0.740 U	0.740 U	0.740 U	0.740 U	0.740 U	0.740 U	--	--	
BHC (alpha)	0.160 U	0.160 U	0.990 U	0.160 U	0.160 U	0.160 U	0.160 U	0.160 U	0.160 U	0.160 U	--	--	
BHC (beta)	0.410 U	0.870 U	0.990 U	0.410 U	1.00 U	0.410 U	<b>0.770 J</b>	0.990 U	0.410 U	0.410 U	--	--	
BHC (delta)	0.200 U	1.30 U	0.200 U	0.200 U	0.200 U	3.90 U	0.200 U	0.200 U	0.200 U	0.200 U	--	--	
BHC (gamma) Lindane	<b>0.760 J</b>	<b>0.410 J</b>	0.210 U	0.210 U	0.210 U	<b>2.50</b>	0.210 U	0.210 U	0.210 U	0.210 U	--	--	
Chlordane (alpha)	28.0 UJ	0.250 U	0.250 U	0.250 U	0.250 U	220 U	0.250 U	0.250 U	0.250 U	0.250 U	3.30	ATLs	
Chlordane (gamma)	<b>660</b>	<b>1,600</b>	<b>1.10</b>	<b>0.630 J</b>	<b>0.720 J</b>	<b>5,000</b>	<b>1.30</b>	<b>0.400 J</b>	<b>1.00</b>	0.260 U	3.30	ATLs	
Diekdrin	<b>370</b>	<b>950</b>	<b>0.720 J</b>	0.200 U	0.260 U	<b>2,900</b>	<b>0.830 J</b>	0.200 U	0.690 U	0.200 U	0.0720	ATLs	
Endosulfan I	<b>95.0 J</b>	<b>210</b>	0.220 U	0.220 U	0.220 U	5.50 U	<b>0.390 J</b>	0.220 U	0.220 U	0.220 U	--	--	
Endosulfan II	4.90 U	11.0 U	0.240 U	0.240 U	0.240 U	0.240 U	0.240 U	0.240 U	0.240 U	0.240 U	--	--	
Endosulfan Sulfate	1.00 U	87.0 U	0.530 U	0.530 U	0.530 U	140 U							

**Table 2**  
**Forebay Smallmouth Bass - Analytical Results and Screening Criteria for PCB Aroclors, Metals, PAHs, Pesticides, Butyltins, and SVOCs**

Area	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	SLV Source
Site ID	73	74	76	78	79	81	82	83	84	Selected SLV
Sample ID	R09042011SB73	R09042011SB74	R09042011SB76	R09042011SB78	R09042011SB79	R09042011SB81	R09042011SB82	R09042011SB83	R09042011SB84	SLV Source
Sample Date	9/4/2011	9/4/2011	9/4/2011	9/4/2011	9/4/2011	9/4/2011	9/4/2011	9/4/2011	9/4/2011	SLV Source
Percent Lipids	2.6	3.7	3.4	2.9	3.5	3	0.71	3	6.4	SLV Source
<b>PCB Aroclors (µg/kg wet)</b>										
Aroclor 1016	2.80 U	2.80 U	2.80 U	280 U	2.80 U	2.80 U	2.80 U	2.80 U	2.80 U	0.570 HH
Aroclor 1221	2.80 U	2.80 U	2.80 U	280 U	2.80 U	2.80 U	2.80 U	2.80 U	2.80 U	0.570 HH
Aroclor 1232	2.80 U	2.80 U	2.80 U	280 U	2.80 U	2.80 U	2.80 U	2.80 U	2.80 U	0.570 HH
Aroclor 1242	2.80 U	2.80 U	2.80 U	280 U	2.80 U	2.80 U	2.80 U	2.80 U	2.80 U	0.570 HH
Aroclor 1248	2.80 U	2.80 U	2.80 U	280 U	2.80 U	2.80 U	2.80 U	2.80 U	2.80 U	0.570 HH
Aroclor 1254	5.00 U	<b>38.0</b>	<b>12.0</b>	<b>27,000</b>	<b>190</b>	23.0 U	16.0 U	9.20 U	<b>50.0</b>	0.570 HH
Aroclor 1260	2.80 U	2.80 U	2.80 U	280 U	2.80 U	2.80 U	2.80 U	2.80 U	2.80 U	0.570 HH
Aroclor 1262	2.80 U	2.80 U	2.80 U	280 U	2.80 U	2.80 U	2.80 U	2.80 U	2.80 U	0.570 HH
Aroclor 1268	2.80 U	2.80 U	2.80 U	280 U	2.80 U	2.80 U	2.80 U	2.80 U	2.80 U	0.570 HH
Total PCBs as Aroclors (NDs at MDL) <sup>1</sup>										0.570 HH
<b>Metals (mg/kg wet)</b>										
Aluminum	<b>0.470 J</b>	<b>3.80</b>	<b>3.87</b>	<b>5.18</b>	<b>1.89</b>	<b>0.340 J</b>	<b>0.910</b>	<b>4.82</b>	<b>0.570 J</b>	-- --
Antimony	<b>0.00710 J</b>	<b>0.00950 J</b>	<b>0.00530 J</b>	<b>0.0105 J</b>	<b>0.00390 J</b>	<b>0.0107 J</b>	<b>0.00730 J</b>	<b>0.00800 J</b>	<b>0.00290 J</b>	-- --
Arsenic	<b>0.257</b>	<b>0.419</b>	<b>0.373</b>	<b>0.289</b>	<b>0.275</b>	<b>0.236</b>	<b>0.225</b>	<b>0.278</b>	<b>0.393</b>	0.000760 HH
Barium	<b>1.72</b>	<b>3.27</b>	<b>5.50</b>	<b>2.22</b>	<b>1.96</b>	<b>1.71</b>	<b>2.47</b>	<b>6.12</b>	<b>1.09</b>	-- --
Beryllium	0.000800 U	0.000800 U	0.000800 U	0.000800 U	0.000800 U	0.000900 U	0.000700 U	0.000700 U	0.000900 U	-- --
Cadmium	<b>0.00810</b>	<b>0.0196</b>	<b>0.0204</b>	<b>0.0101</b>	<b>0.00820</b>	<b>0.00590</b>	<b>0.00960</b>	<b>0.0208</b>	<b>0.00540 J</b>	0.150 Eco
Chromium	0.0200 U	<b>0.160</b>	<b>0.140</b>	<b>0.180</b>	<b>0.500</b>	<b>0.0400 J</b>	<b>0.0800</b>	<b>0.0700</b>	0.0300 U	-- --
Cobalt	<b>0.00800</b>	<b>0.0120</b>	<b>0.0150</b>	<b>0.0120</b>	<b>0.0130</b>	<b>0.00800</b>	<b>0.0180</b>	<b>0.0150</b>	<b>0.00800</b>	-- --
Copper	<b>0.518</b>	<b>1.68</b>	<b>1.69</b>	<b>1.08</b>	<b>0.806</b>	<b>0.349</b>	<b>0.507</b>	<b>2.02</b>	<b>0.297</b>	-- --
Lead	0.0133 U	0.00790 U	0.00990 U	<b>0.0155</b>	0.0114 U	0.0112 U	0.00980 U	0.0132 U	0.00840 U	0.120 Eco
Mercury	<b>0.122</b>	<b>0.228</b>	<b>0.0967</b>	<b>0.0941</b>	<b>0.178</b>	<b>0.220</b>	<b>0.234</b>	<b>0.105</b>	<b>0.127</b>	0.0490 HH
Nickel	<b>0.0380 J</b>	<b>0.0820</b>	<b>0.0860</b>	<b>0.0780</b>	<b>0.183</b>	<b>0.0490 J</b>	<b>0.0980</b>	<b>0.0820</b>	<b>0.0390 J</b>	-- --
Thallium	<b>0.0131</b>	<b>0.0132</b>	<b>0.0123</b>	<b>0.0121</b>	<b>0.0126</b>	<b>0.0105</b>	<b>0.0100</b>	<b>0.0101</b>	<b>0.0128</b>	-- --
Vanadium	<b>0.0380 J</b>	<b>0.0570</b>	<b>0.0360 J</b>	<b>0.0310 J</b>	<b>0.0400 J</b>	<b>0.0330 J</b>	<b>0.0470 J</b>	<b>0.0430 J</b>	<b>0.0230 J</b>	-- --
Zinc	<b>13.0</b>	<b>13.4</b>	<b>13.7</b>	<b>13.5</b>	<b>16.5</b>	<b>11.7</b>	<b>14.3</b>	<b>13.7</b>	<b>11.4</b>	-- --
<b>Butyltins (µg/kg wet)</b>										
Dibutyltin Cation	0.110 U	0.110 U	0.110 U	0.110 U	0.110 U	0.110 U	0.110 U	0.110 U	0.110 U	-- --
Monobutyltin	0.180 U	0.180 U	<b>0.220 J</b>	0.180 U	0.180 U	0.180 U	0.180 U	0.180 U	0.180 U	-- --
Tetrabutyltin	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U	-- --
Tri-n-butyltin	0.110 U	0.110 U	0.110 U	0.110 U	0.110 U	0.110 U	0.110 U	0.110 U	0.110 U	ATLs
<b>Pesticides (µg/kg wet)</b>										
4,4'-DDD	<b>1.70</b>	<b>4.50</b>	<b>2.80</b>	<b>3.00 U</b>	<b>8.60</b>	<b>6.00</b>	<b>3.90</b>	<b>3.20</b>	<b>8.60</b>	-- --
4,4'-DDE	<b>16.0</b>	<b>36.0</b>	<b>22.0</b>	23.0 U	<b>76.0</b>	<b>72.0</b>	<b>38.0</b>	<b>21.0</b>	<b>68.0</b>	-- --
4,4'-DDT	1.30 U	11.0 U	<b>2.90 J</b>	5,000 U	<b>17.0 J</b>	4.30 U	<b>2.80 J</b>	1.70 U	9.30 U	3.40 ATLs
Aldrin	0.740 U	0.740 U	0.740 U	0.740 U	0.740 U	0.740 U	0.740 U	0.740 U	0.740 U	-- --
BHC (alpha)	0.200 U	0.210 U	0.160 U	0.220 U	0.160 U	0.160 U	0.160 U	0.160 U	0.160 U	-- --
BHC (beta)	0.410 U	<b>0.700 J</b>	0.870 U	<b>0.460 J</b>	<b>0.670 J</b>	1.30 U	0.410 U	<b>1.20</b>	<b>2.00</b>	-- --
BHC (delta)	0.200 U	0.200 U	0.200 U	0.200 U	0.220 U	0.230 U	0.200 U	0.200 U	0.200 U	-- --
BHC (gamma) Lindane	0.210 U	0.210 U	0.210 U	0.210 U	<b>0.970 J</b>	0.970 U	0.210 U	0.960 U	0.940 U	-- --
Chlordane (alpha)	0.250 U	0.250 U	0.250 U	72.0 U	0.250 U	0.250 U	0.250 U	0.250 U	<b>0.300 J</b>	3.30 ATLs
Chlordane (gamma)	0.260 U	<b>2.00</b>	<b>0.460 J</b>	<b>1,200</b>	<b>3.70</b>	<b>0.560 J</b>	0.550 U	0.290 U	<b>0.990</b>	3.30 ATLs
Dieldrin	0.200 U	<b>1.50</b>	0.200 U	<b>740</b>	2.40 U	0.970 U	0.200 U	<b>0.270 J</b>	0.940 U	0.0720 ATLs
Endosulfan I	0.220 U	0.220 U	0.220 U	<b>190</b>	<b>1.50</b>	0.530 U	0.220 U	0.220 U	0.440 U	-- --
Endosulfan II	0.240 U	0.240 U	0.240 U	8.60 U	0.240 U	0.240 U	0.240 U	0.240 U	0.940 U	-- --
Endosulfan Sulfate	0.530 U	0.530 U	0.530 U	0.530 U	0.530 U	0.530 U	0.530 U	0.530 U	0.530 U	-- --
Endrin	0.280 U	<b>0.620 J</b>	0.280 U	<b>390</b>	<b>0.940 J</b>	<b>0.300 J</b>	0.280 U	0.280 U	0.940 U	-- --
Endrin Aldehyde	0.620 U	<b>1.00</b>	0.620 U	<b>440</b>	<b>1.30</b>	0.620 U	0.620 U	0.620 U	0.620 U	-- --
Endrin Ketone	0.390 U	0.390 U	0.390 U	19.0 U	0.390 U	0.390 U	0.390 U	0.390 U	0.390 U	-- --
Heptachlor	0.270 U	0.270 U	0.270 U	0.270 U	0.620 U	0.270 U	0.270 U	0.270 U	0.940 U	-- --
Heptachlor Epoxide	0.180 U	0.180 U	0.180 U	12.0 U	0.980 U	0.180 U	0.180 U	0.180 U	0.180 U	-- --
Methoxychlor	0.480 U	0.480 U	0.480 U	4.40 U	0.480 U	<b>0.800 J</b>	0.840 U	0.480 U	<b>0.900 J</b>	-- --

**Table 5**  
Reference Area Smallmouth Bass - Analytical Results and Screening Criteria for PCB Congeners  
August 2011 Sampling

IUPAC #	COELUTING CONGENERS <sup>1</sup>	39 R08202011SB	39 8/20/2011	41 R08202011SB	41 8/20/2011	42 R08202011SB	42 8/20/2011	43 R08202011SB	43 8/20/2011	44 R08202011SB	44 8/20/2011	45 R08202011SB	45 8/20/2011	46 R08202011SB	46 8/20/2011	47 R08202011SB	47 8/20/2011	48 R08202011SB	48 8/20/2011
Individual Congeners in pg/g (ng/kg), wet weight																			
1		1.38 J	0.644 J	0.610 J	0.794 J	0.829 J	0.759 J	0.743 J	2.090 U	1.29 J									
2		0.615 J	1.980 U	0.579 J	0.874 J	0.834 J	0.493 J	0.600 J	0.678 J	0.809 J									
3		1.17 J	1.980 U	1.940 U	1.950 U	2.140 U	2.090 U	2.090 U	2.090 U	2.090 U									
4		4.68	2.38:	2.90	3.73	3.78	2.71	1.97 J	2.01 J	4.38									
5		0.195 J	0.130 U	0.198 U	0.204 J	0.169 U	0.140 U	0.248 U	0.179 U	0.174 J									
6		1.66 J	0.817 J	1.25 J	2.09	1.46 J	0.952 J	1.54 J	0.891 J	1.79 J									
7		0.751 J	0.486 J	0.494 J	0.599 J	0.641 J	0.571 J	0.388 J	0.290 J	0.614 J									
8		6.90	3.69:	6.30	9.81	6.94	4.48	2.92	4.78	8.24									
9		0.665 J	0.402 J	0.528 J	0.720 J	0.623 J	0.444 J	0.248 J	0.306 J	0.707 J									
10		0.249 J	0.123 J	0.160 U	0.193 J	0.186 J	0.148 J	0.200 U	0.144 U	0.221 J									
11		203	118:	157	257	307	162	67.6	433	343									
12	12 + 13	0.183 C U	0.128 C U	0.186 C U	0.190 C U	0.170 C U	0.141 C U	1.10 C J	0.180 C U	0.131 C U									
13	12 + 13	C12	C12	C12	C12	C12	C12	C12	C12	C12									
14		0.172 U	0.121 U	0.175 U	0.180 U	0.156 U	0.130 U	0.230 U	0.166 U	0.120 U									
15		2.22	1.57 J	2.25	4.15	3.09	1.87 J	1.12 J	3.35	3.22									
16		4.76	2.80:	7.28	11.6	6.73	3.31	1.95 J	4.87	7.73									
17		7.47	4.48:	12.2	23.5	12.0	5.71	3.69	8.17	14.0									
18	18 + 30	14.2 C	9.47 C	23.8 C	43.7 C	22.9 C	9.96 C	6.63 C	15.4 C	27.3 C									
19		1.46 J	0.807 J	1.65 J	2.42	1.66 J	1.16 J	0.737 J	1.20 J	1.78 J									
20	20 + 28	61.5 C	76.6 C	151 C	240 C	120 C	54.9 C	50.2 C	111 C	153 C									
21	21 + 33	11.0 C	10.9 C	23.9 C	42.5 C	20.5 C	9.13 C	7.17 C	15.1 C	24.0 C									
22		12.1	17.2 J	27.2	47.2	21.7	12.3	11.0	22.4	26.0									
23		0.0540 U	0.0670 J	0.148 U	0.212 J	0.132 J	0.0524 U	0.0522 U	0.0870 J	0.144 J									
24		0.262 J	0.206 J	0.498 J	0.713 J	0.397 J	0.231 EMPC	0.109 EMPC	0.259 EMPC	0.541 J									
25		1.88 J	2.33:	4.57	12.0	3.56	2.22	1.57 J	3.94	4.27									
26	26 + 29	6.95 C	7.75 C	15.3 C	31.0 C	13.3 C	6.37 C	5.09 C	11.9 C	15.7 C									
27		1.39 J	0.858 J	1.72 J	3.32	1.82 J	1.02 J	0.638 J	1.35 J	2.15									
28	20 + 28	C20	C20	C20	C20	C20	C20	C20	C20	C20									
29	26 + 29	C26	C26	C26	C26	C26	C26	C26	C26	C26									
30	18 + 30	C18	C18	C18	C18	C18	C18	C18	C18	C18									
31		28.6	31.2:	70.0	122	55.7	29.1	19.9	54.6	69.0									
32		2.23	1.56 J	3.58	9.77	3.98	1.64 J	1.12 J	2.30	4.48									
33	21 + 33	C21	C21	C21	C21	C21	C21	C21	C21	C21									
34		0.168 J	0.204 J	0.304 J	0.722 J	0.443 J	0.154 J	0.135 J	0.302 J	0.523 J									
35		1.930 U	1.980 U	0.160 U	0.155 U	0.197 J	0.169 J	0.0522 U	0.0522 U	0.244 J									
36		0.0536 U	0.0495 U	0.147 U	0.142 U	0.0536 U	0.0522 U	0.311 J	0.0869 U										
37		6.72	6.47:	9.52	17.6	7.29	7.30	3.41	12.6	9.97									
38		0.109 EMPC	0.358 EMPC	0.340 J	0.452 J	0.0536 U	0.0530 U	0.0522 U	0.0694 U	0.0891 U									
39		0.462 J	1.42 J	1.25 J	1.91 J	0.951 J	0.439 J	0.595 J	0.935 J	1.22 J									
40	40 + 41 + 71	22.1 C	78.7 C	54.8 C	98.6 C	42.8 C	19.8 C	22.5 C	39.6 C	48.1 C									
41	40 + 41 + 71	C40	C40	C40	C40	C40	C40	C40	C40	C40									
42		17.8	69.3:	44.7	92.5	31.1	17.1	26.6	33.9	37.7									
43		4.17	11.4:	10.9	15.7	7.17	2.55	4.54	5.89	8.46									
44	44 + 47 + 65	121 C	460 C	306 C	533 C	211 C	97.1 C	159 C	212 C	275 C									
45	45 + 51	6.68 C	9.74 C	12.7 C	25.5 C	10.1 C	5.59 C	4.69 C	9.33 C	11.8 C									
46		1.51 J	1.17 J	2.83	5.21	2.06 J	1.25 J	0.949 J	2.44	2.67									
47	44 + 47 + 65	C44	C44	C44	C44	C44	C44	C44	C44	C44									
48		15.1	48.8:	38.4	64.9	26.6	11.7	18.9	24.2	32.7									
49	49 + 69	93.4 C	364 C	244 C	420 C	171 C	74.7 C	126 C	170 C	211 C									
50	50 + 53	4.50 C	6.35 C	10.3 C	25.4 C	7.57 C	4.83 C	3.66 C	8.54 C	9.09 C									
51	45 + 51	C45	C45	C45	C45</														

**Table 5**  
**Reference Area Smallmouth Bass - Analytical Results and Screening Criteria for PCB Congeners**  
**August 2011 Sampling**

IUPAC #	COELUTING CONGENERS <sup>1</sup>	39 Ru820201SB 39 8/20/2011	41 Ru820201SB 41 8/20/2011	42 Ru820201SB 42 8/20/2011	43 Ru820201SB 43 8/20/2011	44 Ru820201SB 44 8/20/2011	45 Ru820201SB 45 8/20/2011	46 Ru820201SB 46 8/20/2011	47 Ru820201SB 47 8/20/2011	48 Ru820201SB 48 8/20/2011
165	128 + 166	1.94	11.6	5.34	8.63	2.78	1.84 J	6.25	2.98	5.14
166		C128								
167		103	295	233	467	120	76.8	331	124	231
168	153 + 168	C153								
169	1.41 U	4.46 U	3.68 U	6.87 U	1.69 U	0.818 U	2.95 U	1.51 U	2.87 U	
170	332	2,270	834	1,380	447	242	919	401	815	
171	171 + 173	130 C	866 C	337 C	678 C	154 C	98.3 C	372 C	159 C	294 C
172		71.2	518	173	267	81.6	51.0	154	79.8	141
173	171 + 173	C171								
174	87.9	630	225	301	97.7	105	188	139	141	
175	14.5	71.1	32.1	51.3	14.9	12.1	37.5	19.1	25.2	
176	12.0	84.5	32.8	56.4	12.0	18.2	35.8	23.5	19.0	
177	165	899	411	643	171	188	541	256	316	
178	140	623	359	668	159	112	426	189	296	
179	97.8	381	251	335	111	83.4	191	148	167	
180	180 + 193	940 C	6,640 C	2,380 C	4,760 C	1,220 C	724 C	3,350 C	1,130 C	2,420 C
181		7.03	37.6	16.2	36.3	7.58	4.92	20.3	7.62	14.2
182	4.66	26.0	11.2	16.5	6.12	3.42	11.1	4.97 J	8.82	
183	183 + 185	324 C	2,110 C	797 C	1,490 C	375 C	232 C	948 C	392 C	668 C
184		4.11	13.6	8.84	17.6	4.64 J	2.80	9.64	4.56 J	9.00
185	183 + 185	C183								
186	0.0666 U	0.114 U	0.0794 U	0.115 U	0.0617 U	0.0522 U	0.0876 U	0.0894 U	0.0593 U	
187	921	3,730	2,200	3,950	936	810	3,370	1,190	1,880	
188	2.31	10.2	5.64	9.65	2.72 J	2.02 J	7.53	2.96 J	5.10	
189	15.4	94.4	36.4	70.6	17.9	10.4	43.5	15.8	35.9	
190	126	641	312	657	154	87.2	412	143	309	
191	17.8	119	40.7	83.6	19.3	12.3	54.3	18.5	37.3	
192	0.0809 U	0.135 U	0.0964 U	0.137 U	0.0719 U	0.0536 U	0.107 U	0.104 U	0.0724 U	
193	180 + 193	C180								
194	102	960	260	531	159	99.8	431	129	333	
195	60.9	401	159	337	88.3	52.0	249	74.3	197	
196	74.1	552	172	326	86.2	47.4	202	70.9	158	
197	197 + 200	18.7 C	121 C	42.5 C	86.6 C	16.2 C	13.5 C	45.9 C	18.8 C	32.4 C
198	198 + 199	162 C	1,040 C	387 C	638 C	182 C	116 C	401 C	175 C	303 C
199	198 + 199	C198								
200	197 + 200	C197								
201	24.6	110	55.4	107	26.4	19.9	72.6	28.6	48.6	
202	69.5	367	192	404	92.8	57.4	245	89.6	176	
203	160	1,140	399	915	191	106	473	159	363	
204	0.339 EMPC	1.71 J	0.960 J	1.60 J	0.394 J	0.223 J	0.999 J	0.370 EMPC	0.719 J	
205	7.48	53.7	17.9	45.7	9.59	5.66	25.6	8.02	19.6	
206	53.0	339	131	284	63.0	35.6	145	51.0	119	
207	12.2	56.5	29.5	62.6	15.5	8.77	39.0	13.0	30.4	
208	19.3	92.4	47.8	82.8	23.2	14.8	48.5	21.4	41.0	
209	24.0	93.3	60.4	137	28.0	21.3	78.5	25.6	63.9	

Maximum Detected Concentration	3,190 C	17,000 C	9,480 C	19,200 C	4,070 C	2,560 C	13,400 C	4,440 C	8,950 C	Total PCB SLV
Minimum Detected Concentration	0.109 EMPC	0.0670 J	0.173 EMPC	0.193 J	0.103 J	0.0550 J	0.0630 J	0.0870 J	0.0860 EMPC	pg/g
Total of Detected Concentrations	17,155 J	105,973 J	55,610 J	101,215 J	29,089 J	18,067 J	60,324 J	32,926 J	49,848 J	570

**Notes:**

C = Concentration represents coeluting congeners.

U = The analyte was not detected above the RDL.

J = The reported value is an estimate.

UJ = The analyte was not detected. The RDL is an estimate.

ng/kg = nanogram/kilogram

pg/g = picograms/gram

EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.

<sup>1</sup>= When two or more congeners can not be resolved in the chromatogram they are considered to be "coeluting" and are reported as a single concentration. This concentration is reported once for all the coeluting congeners.

RDL = Reported detection limit

**Table 5**  
Reference Area Smallmouth Bass - Analytical Results and Screening Criteria for PCB Congeners  
August 2011 Sampling

IUPAC #	COELUTING CONGENERS <sup>1</sup>	49 RB8202011SB 49 8/2/2011	50 RB8202011SB 50 8/20/2011	52 RB8202011SB 52(Duplicate) 8/20/2011	55 RB8212011SB 55 8/21/2011	56 RB8212011SB 56 8/21/2011	57 RB8212011SB 57 8/21/2011	58 RB8212011SB 58 8/21/2011	59 RB8212011SB 59 8/21/2011	60 RB8212011SB 60 8/21/2011	61 RB8212011SB 61 8/21/2011	
Individual Congeners in pg/g (ng/kg), wet weight												
1		1.25 J	3.18	0.561 J	0.771 J	1.14 J	1.53 J	1.26 J	0.865 J	0.715 J	0.907 J	
2		0.801 J	1.47 J	1.990 U	1.38 J	0.807 J	0.644 J	0.852 J	1.34 J	0.818 J	0.644 J	
3		2.120 U	2.10 J	1.990 U	2.130 U	2.250 U	2.150 U	2.200 U	2.180 U	2.200 U	2.130 U	
4		3.99	715	2.30	3.45	2.98	3.47	4.16	3.03	2.72	2.83	
5		0.172 U	0.252 U	0.294 U	0.181 J	0.173 U	0.17 U	0.164 U	0.222 U	0.147 J	0.143 U	
6		1.62 J	125	0.972 J	2.16	1.15 J	1.09 J	1.58 J	1.45 J	1.14 J	0.895 J	
7		0.538 J	169	0.300 J	0.466 J	0.282 J	0.290 J	0.361 J	0.297 J	0.340 J	0.259 J	
8		7.76	212	4.63	9.22	5.78	4.79	7.80	7.35	5.85	4.71	
9		0.612 J	503	0.503 J	0.581 J	0.417 J	0.394 J	0.589 J	0.532 J	0.469 J	0.341 J	
10		0.199 J	31.1	0.240 U	0.143 J	0.148 J	0.152 J	0.206 J	0.189 J	0.116 U	0.143 J	
11		336	403	108	183	308	225	437	217	346	270	
12	12 + 13	0.174 C U	14.8 C	0.279 C U	0.797 C J	0.184 C U	0.125 C U	0.174 C U	0.581 C J	0.688 C J	0.151 C U	
13	12 + 13	C12	C12	C12	C12	C12	C12	C12	C12	C12	C12	
14		0.160 U	0.245 U	0.262 U	0.147 U	0.168 U	0.114 U	0.159 U	0.215 U	0.132 U	0.138 U	
15		3.16	55.8	1.99 U	3.87	2.80	2.12 J	3.44	2.51	3.16	2.36	
16		7.05	74.3	4.87	10.8	5.39	3.87	6.21	8.41	7.32	3.84	
17		12.5	2,580	8.18	16.8	8.19	5.53	13.4	12.7	11.6	6.07	
18	18 + 30	24.8 C	1,350 C	15.5 C	34.8 C	16.3 C	11.1 C	27.0 C	25.3 C	22.6 C	12.4 C	
19		1.65 J	779	1.24 J	2.49	1.21 J	0.977 J	1.83 J	1.40 J	1.53 J	1.08 J	
20	20 + 28	148 C	1,230 C	88.2 C	215 C	94.4 C	58.9 C	140 C	123 C	113 C	74.1 C	
21	21 + 33	23.5 C	133 C	14.2 C	36.8 C	15.9 C	10.1 C	23.0 C	26.5 C	20.5 C	11.2 C	
22		25.5	112	18.8	44.8	17.0	10.9	24.2	25.2	21.8	13.8	
23		0.139 J	1,47 J	0.0860 J	0.222 J	0.0870 J	0.0640 EMPC	0.111 J	0.0960 J	0.102 J	0.070 J	
24		0.535 J	0.0524 U	0.294 EMPC	0.604 J	0.266 EMPC	0.224 J	0.461 EMPC	0.433 J	0.410 J	0.211 J	
25		4.09	512	3.21	9.17	2.85	1.85 J	3.70	3.96	3.81	2.28	
26	26 + 29	15.0 C	1,520 C	9.69 C	23.9 C	9.86 C	6.13 C	14.3 C	13.3 C	12.7 C	7.71 C	
27		1.89 J	930	1.27 J	2.47	1.35 J	0.896 J	2.18 J	1.83 J	1.81 J	0.992 J	
28	20 + 28	C20	C20	C20	C20	C20	C20	C20	C20	C20	C20	
29	26 + 29	C26	C26	C26	C26	C26	C26	C26	C26	C26	C26	
30	18 + 30	C18	C18	C18	C18	C18	C18	C18	C18	C18	C18	
31		66.8	812	43.9	113	43.4	28.7	58.9	62.7	58.7	34.0	
32		4.06	804	2.53	6.25	2.32	1.49 J	3.97	4.48	3.24	1.75 J	
33	21 + 33	C21	C21	C21	C21	C21	C21	C21	C21	C21	C21	
34		0.491 J	20.4	0.253 J	0.784 J	0.366 J	0.193 J	0.529 J	0.393 J	0.449 J	0.229 J	
35		0.227 EMPC	0.496 U	0.0840 U	0.105 U	0.177 J	0.146 J	0.252 J	0.0900 EMPC	0.207 J	0.392 J	
36		0.0751 U	0.440 U	0.0768 U	0.0931 U	0.102 EMPC	0.0538 U	0.0718 U	0.0738 U	0.0719 U	0.0540 U	
37		9.73	70.0	6.99	17.1	7.75	6.48	8.53	7.92	10.0	7.29	
38		0.0770 U	2.21	0.176 J	0.474 J	0.119 J	0.126 J	0.259 J	0.212 EMPC	0.230 J	0.145 J	
39		1.27 J	11.9	0.689 J	1.77 J	0.686 J	0.427 J	0.962 J	0.863 J	0.696 J	0.499 J	
40	40 + 41 + 71	49.8 C	1,570 C	35.2 C	93.5 C	31.6 C	21.2 C	47.6 C	43.0 C	47.3 C	22.2 C	
41	40 + 41 + 71	C40	C40	C40	C40	C40	C40	C40	C40	C40	C40	
42		38.1	670	50.3	84.4	23.7	15.9	35.7	30.7	36.5	17.5	
43		9.07	117	6.16	11.7	5.23	3.25	7.73	6.60	6.83	3.56	
44	44 + 47 + 65	275 C	7,040 C	179 C	470 C	158 C	107 C	249 C	193 C	219 C	121 C	
45	45 + 51	11.0 C	646 C	9.66 C	22.2 C	6.81 C	5.12 C	10.5 C	9.39 C	11.5 C	5.19 C	
46		2.38	132	2.34	4.76	1.85 J	1.30 J	2.42	2.29	2.72	1.23 J	
47	44 + 47 + 65	C44	C44	C44	C44	C44	C44	C44	C44	C44	C44	
48		33.0	346	22.3	54.2	20.0	13.3	31.7	27.3	28.6	13.9	
49	49 + 69	210 C	4,900 C	139 C	377 C	126 C	85.9 C	199 C	156 C	177 C	99.1 C	
50	50 + 53	8.59 C	1,960 C	20.0 C	5.86 C	4.18 C	8.36 C	6.82 C	9.85 C	4.23 C		
51	45 + 51	C45	C45	C45	C45	C45	C45	C45	C45	C45	C45	
52		497	15,700	309	772	304	209	484	345	414	250	
53	50 + 53	C50	C50	C50	C50	C50	C50	C50	C50	C50	C50	
54		0.182 J	84.3	0.127 J	0.347 EMPC	0.111 J	0.113 J	0.165 J	0.109 J	0.143 J	0.0840 J	
55		0.483 U	0.766 U	0.275 U	0.335 U	0.249 U	0.373 U	0.386 U	0.354 U	0.421 U	0.374 U	
56		50.5	1,200	48.0	132	29.9	20.9	41.6	36.3	43.9	26.4	
57		2.30	18.5	1.70 J	3.86	1.31 J	0.963 J	1.99 J	1.60 J	1.56 J	1.14 J	
58		1.85 J	0.718 U	1.56 J	3.54	1.19 J	0.818 J	1.75 J	1.40 J	1.31 J	0.923 J	
59	59 + 62 + 75	26.0 C	201 C	16.8 C	39.9 C	14.4 C	9.66 C	22.2 C	17.8 C	19.8 C	11.1 C	
60		148	748	83.8	205	79.3	58.0					

**Table 5**  
Reference Area Smallmouth Bass - Analytical Results and Screening Criteria for PCB Congeners  
August 2011 Sampling

IUPAC #	COELUTING CONGENERS <sup>1</sup>	49 RB202011SB 49 8/20/2011	50 RB202011SB 50 8/20/2011	52 RB202011SB 52(Duplicate) 8/20/2011	55 RB212011SB 55 8/21/2011	56 RB212011SB 56 8/21/2011	57 RB212011SB 57 8/21/2011	58 RB212011SB 58 8/21/2011	59 RB212011SB 59 8/21/2011	60 RB212011SB 60 8/21/2011	61 RB212011SB 61 8/21/2011
179		188	605	143	376	96.2	78.5	179	115	134	73.9
180	180 + 193	2,390 C	5,290 C	1,580 C	3,100 C	1,030 C	976 C	1,650 C	1,310 C	1,180 C	879 C
181		15.3	67.4	10.7	23.8	6.18	5.87	10.1	8.01	6.87	5.06
182		9.19 J	34.8	6.34	16.9	4.48	3.89	6.85	5.78	5.25	3.56
183	183 + 185	730 C	1,740 C	445 C	958 C	304 C	271 C	514 C	377 C	350 C	254 C
184		9.13 J	10.9 J	3.83	9.60	3.81	3.38	6.40	4.07	4.30	3.03
185	183 + 185	C183	C183	C183	C183	C183	C183	C183	C183	C183	C183
186		0.212 U	2.01 J	0.0877 U	0.240 U	0.0562 U	0.0539 U	0.0728 U	0.0792 U	0.0814 U	0.0533 U
187		1,830	3,410	2,010	2,860	651	745	1,410	1,160	1,030	765
188		4.45 EMPC	7.76 J	4.58	7.06 J	2.39	2.15 J	4.10	2.83	3.00	2.21
189		34.3	118	23.7	52.5	15.7	15.4	25.7	20.0	18.0	13.5
190		305	576	184	322	122	118	212	152	141	105
191		39.7	112	26.5	50.8	16.1	15.6	26.8	20.8	18.2	13.6
192		0.271 J	0.852 U	0.107 U	0.280 U	0.0562 U	0.0632 U	0.0853 U	0.0927 U	0.0719 U	0.0533 U
193	180 + 193	C180	C180	C180	C180	C180	C180	C180	C180	C180	C180
194		311	608	153	407	138	110	183	167	130	95.3
195		165	259	97.5	175	75.1	71.2	130	86.0	88.0	65.1
196		164	310	106	205	71.5	72.6	124	93.8	81.2	66.9
197	197 + 200	33.8 C	83.7 C	29.3 C	59.8 C	15.8 C	13.8 C	26.2 C	17.6 C	21.3 C	13.4 C
198	198 + 199	313 C	645 C	272 C	594 C	161 C	144 C	262 C	197 C	212 C	142 C
199	198 + 199	C198	C198	C198	C198	C198	C198	C198	C198	C198	C198
200	197 + 200	C197	C197	C197	C197	C197	C197	C197	C197	C197	C197
201		52.2	100	43.7	79.7	23.1	20.7	40.1	29.3	28.8	20.8
202		169	254	98.0	243	79.6	66.3	134	89.0	96.5	65.4
203		366	578	211	466	158	149	267	184	185	139
204		0.639 EMPC	1.41 J	0.443 J	1.03 EMPC	0.240 J	0.329 J	0.592 J	0.448 J	0.405 J	0.285 J
205		19.4	33.7	10.7	23.2	8.32	7.42	13.2	9.34	9.37	6.63
206		112	218	69.3	180	61.8	52.4	87.8	67.4	69.2	46.5
207		29.5	46.2	18.9	35.9	13.2	12.6	21.4	17.0	15.2	11.6
208		38.2	66.0	30.4	76.5	22.5	18.7	34.0	24.8	27.6	17.6
209		57.3	67.2	43.1	74.9	30.2	26.5	44.5	34.1	36.8	24.7

Maximum Detected Concentration	8,560 C	33,900 C	5,760 C	10,200 C	3,570 C	3,000 C	5,680 C	4,250 C	3,950 C	2,920 C	Total PCB SLV
Minimum Detected Concentration	0.0910 J	1.41 J	0.0800 J	0.143 J	0.0870 J	0.0640 EMPC	0.0910 J	0.0900 EMPC	0.102 J	0.0710 J	pg/g
Total of Detected Concentrations	49,215 J	407,012 J	33,178 J	75,508 J	24,302 J	20,676 J	39,535 J	28,363 J	30,017 J	20,416 J	570

**Notes:**

C = Concentration represents coeluting congeners.

U = The analyte was not detected above the RDL.

J = The reported value is an estimate.

UJ = The analyte was not detected. The RDL is an estimate.

ng/kg = nanogram/kilogram

pg/g = picograms/gram

EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.

<sup>1</sup>= When two or more congeners can not be resolved in the chromatogram they are considered to be 'coeluting' and are reported as a single concentration. This concentration is reported once for all the coeluting congeners.

RDL = Reported detection limit

**Table 6**  
**Forebay Smallmouth Bass - Analytical Results and Screening Criteria for PCB Congeners**  
**August 2011 Sampling**

IUPAC #	COELUTING CONGENERS <sup>1</sup>	62 R09032011SB 62 9/3/2011	63 R09032011SB 63 9/3/2011	64 R09032011SB 64 9/3/2011	65 R09032011SB 65 9/3/2011	67 R09032011SB 67 9/3/2011	68 R09032011SB 68 9/3/2011	69 R09032011SB 69 9/3/2011	70 R09032011SB 70 9/3/2011	71 R09042011SB 71 9/4/2011
Individual Congeners in pg/g (ng/kg), wet weight										
1		31.1 U	27.0 J	1.01 J	1.18 J	1.09 J	45.3 J	1.59 J	0.777 J	0.658 J
2		42.2 U	28.6 U	0.551 J	0.711 J	0.579 J	32.0 U	0.513 J	0.488 J	0.704 J
3		40.4 U	28.9 J	2.380 U	2.50 U	2.62 U	53.3 J	2.410 U	2.320 U	2.376 U
4		263 U	217 U	4.68	5.80	3.17	341 J	4.74	3.88	2.10 J
5		199 U	167 U	0.130 U	0.142 J	0.176 U	203 U	0.226 U	0.125 U	0.145 U
6		178 U	150 U	1.37 J	1.62 J	0.982 J	188 J	1.33 J	1.17 J	0.793 J
7		186 U	156 U	0.368 J	0.448 J	0.323 J	189 U	0.239 J	0.275 J	0.215 J
8		268 J	141 U	5.23	6.62	4.24	676 J	5.22	4.67	3.83
9		175 U	146 U	1.06 J	1.42 J	0.408 J	313 J	0.964 J	0.912 J	0.315 J
10		167 U	141 U	0.212 J	0.332 J	0.169 J	171 U	0.210 J	0.188 J	0.117 J
11		220 J	167 U	117	282	176	202 U	132	163	226
12	12 + 13	206 C U	173 C U	0.631 C J	0.697 C J	0.180 C U	210 C U	0.223 C U	0.573 C J	0.148 C U
13	12 + 13	C12								
14		189 U	159 U	0.114 U	0.109 U	0.166 U	193 U	0.211 U	0.110 U	0.137 U
15		203 U	217 J	2.27 J	4.11	2.48 J	410 J	2.46	2.74	2.85
16		584 J	168 J	3.58	5.78	3.05	1,800 J	4.20	4.15	3.47
17		9,160	4,520	22.8	32.9	7.17	29,900	23.2	23.3	8.57
18	18 + 30	6,760 C	7,130 C	25.8 C	37.2 C	11.7 C	27,500 C	26.8 C	27.0 C	14.0 C
19		978 J	143 J	4.17	5.66	1.09 J	2,310	4.08	4.04	1.20 J
20	20 + 28	20,000 C	51,800 C	82.0 C	105 C	71.0 C	131,000 C	80.3 C	73.7 C	65.7 C
21	21 + 33	1,140 C J	2,730 C	7.88 C	11.1 C	6.47 C	7,100 C	7.82 C	7.33 C	8.95 C
22		403 J	2,150	9.10	11.7	6.91	4,270	7.63	7.38	9.39
23		45.7 U	62.8 U	0.0594 U	0.0626 U	0.0736 U	98.1 U	0.0760 U	0.0580 U	0.0754 U
24		27.3 U	23.3 U	0.204 J	0.316 J	0.215 J	54.4 U	0.226 J	0.205 J	0.226 J
25		1,020 J	4,980	4.60	5.19	2.34 J	11,800	5.03	4.70	2.78
26	26 + 29	4,600 C	9,900 C	13.6 C	16.5 C	7.56 C	25,800 C	14.0 C	12.9 C	8.72 C
27		2,750	1,030 J	6.40	9.46	1.64 J	9,170	6.94	6.78	1.76 J
28	20 + 28	C20								
29	26 + 29	C26								
30	18 + 30	C18								
31		3,090	31,400	34.6	40.9	24.4	54,800	35.5	31.1	28.0
32		3,660	1,860	8.68	12.3	2.46 J	14,200	9.33	9.38	2.91
33	21 + 33	C21								
34		81.9 J	151 J	0.269 J	0.325 J	0.153 J	508 J	0.273 J	0.272 J	0.207 J
35		50.3 U	69.2 U	0.164 EMPC	0.261 J	0.164 J	108 U	0.274 J	0.185 EMPC	0.130 EMPC
36		45.3 U	62.3 U	0.0594 U	0.0626 U	0.0742 U	97.2 U	0.0755 U	0.0580 U	0.0761 U
37		1,320 J	3,790	9.14	17.1	11.0	11,800	12.8	11.5	11.2
38		46.7 U	64.3 U	0.144 J	0.159 J	0.159 EMPC	444 J	0.0860 J	0.0780 EMPC	0.119 J
39		404 J	618 J	0.675 J	1.01 J	0.577 J	2,130	0.971 J	0.555 J	0.704 J
40	40 + 41 + 71	39,800 C	48,900 C	53.7 C	69.2 C	33.6 C	196,000 C	66.5 C	54.6 C	40.5 C
41	40 + 41 + 71	C40								
42		22,400	54,300	40.8	48.2	24.2	123,000	47.5	34.8	27.0
43		4,980	6,720	7.38	8.10	4.19	22,100	8.23 EMPC	5.38	5.28
44	44 + 47 + 65	247,000 C	533,000 C	396 C	449 C	214 C	1,490,000 C	464 C	359 C	269 C
45	45 + 51	5,270 C	4,380 C	9.70 C	13.7 C	6.41 C	23,700 C	6.90 C	10.1 C	6.68 C
46		1,600 J	661 J	2.76	4.27	1.77 J	7,240	3.48	3.52	1.82 J
47	44 + 47 + 65	C44								
48		12,600	21,700	21.9	26.8	13.1	54,700	26.1	17.3	16.1
49	49 + 69	200,000 C	614,000 C	345 C	359 C	174 C	1,300,000 C	377 C	276 C	212 C
50	50 + 53	17,000 C	13,800 C	26.6 C	36.2 C	12.5 C	76,000 C	32.2 C	29.9 C	12.9 C
51	45 + 51	C45								
52		700,000	2,150,000	1,290	1,350	631	5,170,000	1,390	1,080	775
53	50 + 53	C50								
54		150 J	114 J	0.334 J	0.430 J	0.143 J	628 J	0.345 J	0.282 J	0.115 J
55		112 U	218 U	0.605 U	0.497 U	0.411 U	263 U	0.324 U	0.331 U	0.410 U
56		8,460	194,000	83.2	70.8	4.17	250,000	100	53.6	49.6
57		263 J	640 J	0.781 J	1.14 J	0.540 J	1,580 J	0.816 J	0.675 J	0.712 J
58		104 U	202 U	0.579 U	0.591 J	0.387 U	244 U	0.310 U	0.351 J	0.386 U
59	59 + 62 + 75	4,670 C	10,900 C	12.1 C	13.6 C	6.85 C	23,000 C	12.2 C	8.18 C	9.15 C
60		64,600	208,000	123	115	63.3	375,000	140	81.0	90.7
61	61 + 70 + 74 + 76	639,000 C	3,870,000 C	1,480 C	1,330 C	808 C	6,350,000 C	1,840 C	981 C	1,130 C
62	59 + 62 + 75	C59								
63		17,100	54,400	31.7	37.2	21.8	91,800	37.3	28.3	33.0
64		81,800	167,000	136	153	74.3	444,000	154	115	98.6
65	44 + 47 + 65	C44								
66		401,000	1,390,000	726	739	440	2,490,000	833	505	649
67		397 J	3,220	3.24	3.96	2.60 J	5,210	3.48	2.09 J	2.36 J
68		335 J	2,330	4.05	5.80	4.20	2,850	6.03	9.02	5.26
69	49 + 69	C49								
70	61 + 70 + 74 + 76	C61								
71	40 + 41 + 71	C40								
72		1,120 J	3,800	4.34	4.78	2.86	6,310	6.65	3.06	4.35
73	117 U	22.0 U	0.0594 U	0.0626 U	0.0656 U	56.8 U	0.0602 U	0.0580 U	0.0592 U	0.0592 U
74	61 + 70 + 74 + 76	C61								
75	59 + 62 + 75	C59								
76	61 + 70 + 74 + 76	C61								
77		2,730	17,500	17.4	33.1	20.2	24,500	35.5	22.3	26.1
78		115 U	224 U	0.583 U	0.487 U	0.429 U	270 U	0.338 U	0.325 U	0.428 U
79		26,700	104,000	32.3	25.8	25.8	206,000	38.9	17.5	27.8
80		101 U	197 U	0.550 U	0.452 U	0.379 U	238 U	0.291 U	0.301 U	0.378 U
81		99.4 U	691 EMPC	0.825 J	1.24 J	1.17 J	1,530 EMPC	1.47 EMPC	1.17 J	1.44 J
82		174,000	499,000	198	161	144	977,000	241	126	164
83	83 + 99	1,840,000 C	6,250,000 C	2,240 C	1,760 C	1,580 C	11,300,000 C	2,540 C	1,180 C	2,560 C
84		243,000	411,000	251	256	187	1,240,000	316	207	212
85	85 + 116 + 117	573,000 C	1,870,000 C	738 C	605 C	529 C	3,200,000 C	796 C	419 C	772 C
86	86 + 87 + 97 + 108 + 119 + 125	1,470,000 C	4,820,000 C	1,730 C	1,360 C	1,250 C	9,650,000 C	2,100 C	1,000 C	1,440 C
87	88 + 91	C86								
88		181,000 C	470,000 C	203 C	182 C	142 C	983,000 C	250 C	138 C	159 C
89		5,860	4,230	3.67	4.47	4.10	26,800	6.36	4.00	4.41
90	90 + 101 + 113	2,100,000 C	7,090,000 C	2,510 C	1,950 C	1,810 C	14,100,000 C	2,990 C	1,420 C	2,190 C
91	88 + 91	C88								
92		303,000	806,000	395	313	270	1,550,000	416	219	358
93	93 + 95 + 98 + 100 + 102	862,000 C	2,440,000 C	1,180 C	1,070 C	832 C	6,320,000 C	1,400 C	840 C	941 C
94		2,490	2,140	2.						

**Table 6**  
**Forebay Smallmouth Bass - Analytical Results and Screening Criteria for PCB Congeners**  
**August 2011 Sampling**

IUPAC #	COELUTING CONGENERS <sup>1</sup>	62 R09032011SB 62 9/3/2011	63 R09032011SB 63 9/3/2011	64 R09032011SB 64 9/3/2011	65 R09032011SB 65 9/3/2011	67 R09032011SB 67 9/3/2011	68 R09032011SB 68 9/3/2011	69 R09032011SB 69 9/3/2011	70 R09032011SB 70 9/3/2011	71 R09042011SB 71 9/4/2011
174		80,700	349,000	217	145	154	550,000	196	88,9	143
175		6,120	19,600	16,9	13,5	12,1	30,700	18,3	9,38	15,7
176		8,330	29,800	28,8	18,5	17,4	54,100	23,5	12,0	12,5
177		72,300	272,000	274	228	212	415,000	250	152	241
178		20,800	70,900	115	101	82,8	103,000	81,6	65,7	117
179		19,000	41,200	111	71,0	54,9	78,300	62,3	45,0	64,6
180	180 + 193	371,000 C	1,170,000 C	1,070 C	1,220 C	1,170 C	1,730,000 C	1,040 C	923 C	1,780 C
181		8,270	25,600	9,44	7,65	8,93	40,000	13,6	5,35	14,6
182		1,480 J	3,720	4,58	3,65	2,87	5,990	3,31	2,47	4,94
183	183 + 185	101,000 C	322,000 C	294 C	238 C	220 C	505,000 C	255 C	163 C	364 C
184		173 J	348 J	2,43	1,65 J	1,31 J	636 J	1,11 J	1,12 J	2,36 J
185	183 + 185	C183								
186		34,2 J	40,3 U	0.0612 U	0.0727 U	0.0717 U	57,0 U	0.115 U	0.0580 U	0.0674 U
187		128,000	462,000	995	1,100	1,010	673,000	942	825	1,340
188		201 J	616 J	2,10 J	2,52	2,12 J	896 J	2,04 J	1,69 J	2,60
189		12,900	37,300	20,2	21,7	21,1	57,800	24,2	15,1	32,8
190		40,500	119,000	101	104	97,3	183,000	109	71,2	166
191		9,620	29,500	17,5	16,9	16,1	44,100	20,7	12,4	26,8
192		36,5 U	47,9 U	0.0681 U	0.0808 U	0.0836 U	67,7 U	0.137 U	0.0580 U	0.0786 U
193	180 + 193	C180								
194		28,100	94,200	121	125	124	137,000	101	96,9	204
195		10,700	33,600	58,4	67,7	55,7	48,100	48,0	46,5	88,3
196		14,000	46,200	65,3	71,4	63,3	66,700	59,5	54,9	99,8
197	197 + 200	2,270 C	8,500 C	18,2 C	14,2 C	12,9 C	13,900 C	14,9 C	9,56 C	14,5 C
198	198 + 199	28,500 C	105,000 C	144 C	160 C	146 C	147,000 C	139 C	115 C	195 C
199	198 + 199	C198								
200	197 + 200	C197								
201		3,320	11,500	26,3	25,8	23,1	17,900	21,4	18,2	39,5
202		5,480	18,600	51,4	47,9	37,9	28,000	33,4	28,7	51,3
203		20,600	58,000	107	110	92,6	77,400	86,9	74,0	160
204		19,8 U	31,5 J	0,182 J	0,190 J	0,186 EMPC	54,2 J	0,224 J	0,128 EMPC	0,301 EMPC
205		1,160 J	3,450	6,11	6,46	5,15	5,020	5,12	4,51	8,26
206		8,400	23,900	44,8	46,2	38,9	38,400	34,9	32,0	69,4
207		1,280 J	4,430	10,8	12,7	11,4	7,480	8,87	9,85	17,3
208		2,020	6,180	17,6	20,4	17,5	10,800	14,9	14,4	24,0
209		1,090 J	2,930	22,9	29,4	25,4	4,310	21,5	23,7	35,3

Maximum Detected Concentration	4,040,000	12,600,000	4,660 C	3,800 C	4,210 C	21,500,000 C	5,000 C	2,490 C	6,400 C	Total PCB SLV
Minimum Detected Concentration	34.2 J	27.0 J	0.144 J	0.142 J	0.143 J	45.3 J	0.0840 J	0.0780 EMPC	0.115 J	pg/g
Total of Detected Concentrations	30,490,201 J	101,475,637 J	43,892 J	37,833 J	34,613 J	183,139,653 J	148,036 J	26,058 J	49,701 J	570

**Notes:**

C = Concentration represents coeluting congeners.

U = The analyte was not detected above the RDL.

J = The reported value is an estimate.

UJ = The analyte was not detected. The RDL is an estimate.

ng/kg = nanogram/kilogram

pg/g = picograms/gram

EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.

<sup>1</sup>= When two or more congeners can not be resolved in the chromatogram they are considered to be 'coeluting' and are reported as a single concentration. This concentration is reported once for all the coeluting congeners.

RDL = Reported detection limit

**Table 6**  
Forebay Smallmouth Bass - Analytical Results and Screening Criteria for PCB Congeners  
August 2011 Sampling

IUPAC #	COELUTING CONGENERS <sup>1</sup>	72 R09042011SB 9/4/2011	73 R09042011SB 9/4/2011	74 R09042011SB 9/4/2011	76 R09042011SB 9/4/2011	78 R09042011SB 9/4/2011	79 R09042011SB 9/4/2011	81 R09042011SB 9/4/2011	82 R09042011SB 9/4/2011	83 R09042011SB 9/4/2011	84 R09042011SB 9/4/2011
Individual Congeners in pg/g (ng/kg), wet weight											
1		0.759 J	0.661 J	0.701 J	0.474 J	30.7 J	0.846 J	2.180 U	0.435 J	0.440 J	0.766 J
2		2.520 U	0.511 J	0.560 J	2.580 U	33.1 U	0.936 J	0.577 J	0.282 EMPC	0.500 J	0.947 J
3		2.520 U	2.300 U	2.660 U	2.580 U	43.1 J	2.19 U	2.180 U	1.910 U	2.400 U	1.950 U
4		2.42 J	2.08 J	2.37 J	1.83 J	267 U	2.66 J	1.85 J	1.11 J	1.78 J	3.61
5		0.123 U	0.112 U	0.136 U	0.197 U	209 U	0.593 U	0.106 U	0.222 U	0.257 U	0.200 U
6		0.904 J	0.730 J	0.999 J	0.710 J	188 U	1.66 J	0.749 J	0.511 J	0.699 J	1.85 J
7		0.225 J	0.218 J	0.257 J	0.180 J	196 U	0.541 U	0.260 J	0.203 U	0.234 U	0.400 J
8		4.08	3.28	4.56	3.32	176 U	5.87	3.88	2.16	3.90	8.29
9		0.339 J	0.278 J	0.356 J	0.260 J	185 U	0.509 U	0.302 J	0.191 U	0.341 J	0.542 J
10		0.120 J	0.102 J	0.110 U	0.160 U	177 U	0.506 U	0.0859 U	0.190 U	0.219 U	0.206 J
11		90.0	165	266	250	209 U	141	178	32.5	152	397
12	12 + 13	0.504 C J	0.610 C J	0.126 C U	0.302 C U	217 C U	0.795 C J	0.109 C U	0.268 C J	0.782 C J	0.197 C U
13	12 + 13	C12									
14		0.108 U	0.0984 U	0.119 U	0.187 U	199 U	0.553 U	0.101 U	0.207 U	0.239 U	0.186 U
15		1.98 J	2.62	3.05	2.50 J	219 U	2.18 J	2.14 J	0.622 J	2.07 J	4.67
16		2.97	2.34	4.50	3.39	94.6 U	7.61	4.08	2.20	3.66	9.91
17		3.69	2.82	6.70	4.76	760 J	14.5	9.57	4.63	12.4	17.8
18	18 + 30	7.72 C	6.49 C	13.7 C	10.4 C	1,470 C J	28.4 C	163 C	7.92 C	14.6 C	32.0 C
19		0.891 J	0.770 J	1.21 J	0.826 J	79.3 U	1.51 J	0.969 J	0.398 J	1.62 J	2.28
20	20 + 28	24.6 C	23.8 C	61.7 C	51.9 C	18,700 C	149 C J	118 C	56.5 C	54.6 C	148 C
21	21 + 33	5.31 C	4.08 C	11.2 C	8.48 C	834 C J	25.2 C	22.0 C	13.4 C	8.82 C	25.9 C
22		5.34	4.85	12.2	9.78	859 J	2.58	2.32	14.0	9.52	26.8
23		0.0631 U	0.0575 U	0.0664 U	0.0646 U	66.2 U	0.155 J	0.0631 U	0.0580 U	0.0661 U	0.140 J
24		0.161 J	0.142 J	0.292 J	0.203 J	60.3 U	0.509 EMPC	0.312 J	0.0740 EMPC	0.155 EMPC	0.567 EMPC
25		1.16 J	0.852 J	2.27 J	1.62 J	1,660 J	6.09	3.93	2.23	2.36 J	4.41
26	26 + 29	3.14 C	2.71 C	7.13 C	5.45 C	3,510 C	16.8 C	12.5 C	7.38 C	7.79 C	15.5 C
27		0.617 J	0.558 J	1.08 J	0.834 J	65.8 J	2.42 J	1.10 J	0.606 J	2.48	2.62
28	20 + 28	C20									
29	26 + 29	C26									
30	18 + 30	C18									
31		12.7	10.9	29.7	24.4	15,600	83.9	54.8	25.7	25.4	72.7
32		1.35 J	0.740 J	2.02 J	1.29 J	367 J	4.91	3.87	1.95	4.13	4.63
33	21 + 33	C21									
34		0.0760 J	0.0710 J	0.205 J	0.157 J	62.0 U	0.583 J	0.282 J	0.159 J	0.178 J	0.611 J
35		0.128 J	0.109 EMPC	0.154 EMPC	0.127 J	72.8 U	0.190 J	0.0960 U	0.0628 U	0.127 EMPC	0.187 J
36		0.0631 U	0.0575 U	0.0664 U	0.0646 U	65.6 U	0.143 U	0.0838 U	0.0576 U	0.0810 J	0.137 EMPC
37		7.32	8.95	12.0	9.09	1,770 J	15.0	9.69	4.15	8.54	14.6
38		0.0631 U	0.0575 U	0.183 J	0.101 J	67.7 U	0.586 J	0.256 J	0.116 J	0.0671 U	0.297 EMPC
39		0.231 J	0.229 J	0.665 J	0.450 J	460 J	2.38	1.15 J	0.660 J	0.556 J	1.05 J
40	40 + 41 + 71	9.10 C	7.96 C	33.0 C	17.4 C	25,000 C	247 C	54.0 C	45.3 C	32.4 C	52.1 C
41	40 + 41 + 71	C40									
42		6.95	6.36	21.4	14.2	38,500	135	44.3	33.8	22.6	37.9
43		1.24 J	1.12 J	5.57	2.98	121 U	24.7	6.81	6.04	4.61	8.90
44	44 + 47 + 65	48.5 C	41.0 C	232 C	99.5 C	344,000 C	1,690 C	247 C	198 C	189 C	244 C
45	45 + 51	2.92 C	2.58 C	6.49 C	4.95 C	551 C J	23.6 C	11.7 C	9.06 C	7.60 C	12.9 C
46		0.757 J	0.727 J	1.64 J	1.19 J	105 U	4.16	2.15 J	2.00	1.86 J	3.14
47	44 + 47 + 65	C44									
48		4.73	4.44	18.2	11.0	15,800	88.0	30.3	23.5	14.5	31.5
49	49 + 69	37.3 C	30.0 C	313 C	80.8 C	442,000 C	1,210 C	201 C	164 C	165 C	191 C
50	50 + 53	3.48 C	2.60 C	6.18 C	4.17 C	3,530 C	37.8 C	9.77 C	8.53 C	14.5 C	11.1 C
51	45 + 51	C45									
52		122	81.6	866	222	1,590,000	4,540	455	434 U	541 U	474 U
53	50 + 53	C50									
54		0.0631 U	0.0575 U	0.112 J	0.0860 J	63.6 U	0.161 U	0.0850 J	0.0720 J	0.217 J	0.154 J
55		0.191 U	0.257 U	0.545 U	0.303 U	211 U	0.614 U	0.346 U	0.124 U	0.499 U	0.107 U
56		13.6	9.39	25.8	28.4	154,000	247	62.5	49.5 U	30.9 U	53.0
57		0.318 J	0.394 J	0.925 J	0.787 J	197 U	1.99 J	1.83 J	1.18 J	0.631 J	1.84 J
58		0.208 J	0.355 J	0.522 U	0.532 J	196 U	0.587 U	1.28 J	0.119 U	0.581 J	1.44 J
59	59 + 62 + 75	2.85 C	3.14 C	12.9 C	8.03 C	7,030 C	48.3 C	19.5 C	14.3 C	8.33 C	21.2 C
60		19.0	22								

**Table 6**  
**Forebay Smallmouth Bass - Analytical Results and Screening Criteria for PCB Congeners**  
**August 2011 Sampling**

IUPAC #	COELUTING CONGENERS <sup>1</sup>	72 R09042011SB 9/4/2011	73 R09042011SB 9/4/2011	74 R09042011SB 9/4/2011	76 R09042011SB 9/4/2011	78 R09042011SB 9/4/2011	79 R09042011SB 9/4/2011	81 R09042011SB 9/4/2011	82 R09042011SB 9/4/2011	83 R09042011SB 9/4/2011	84 R09042011SB 9/4/2011
182		2.56	2.77	11.9	4.56	2,510	19.8	6.25	5.15	2.81	6.97
183	183 + 185	163 C	179 C	732 C	357 C	205,000 C	1,260 C	594 C	427 C	204 C	493 C
184		1.38 J	1.40 J	4.13	2.96	238 J	6.76	4.70	3.73	1.62 J	5.73
185	183 + 185	C183									
186		0.0631 U	0.0575 U	0.0734 U	0.0843 U	50.3 U	0.267 U	0.0683 U	0.0866 U	0.0896 U	0.0853 U
187		850	968	2,340	1,410	254,000	3,050	2,790	2,100	885	1,790
188		1.88 J	2.03 J	5.03	2.74	379 J	6.87 J	5.79	4.92	2.45	3.90
189		12.5	16.9	75.6	25.2	20,900	119	38.9	28.5	15.3	27.8
190		71.7	84.3	310	152	76,700	497	251	170	99.6	212
191		10.9	13.8	57.0	22.9	17,700	97.5	36.5	27.8	14.6	29.6
192		0.0631 U	0.0575 U	0.0817 U	0.0982 U	59.8 U	0.319 U	0.0796 U	0.103 U	0.107 U	0.102 U
193	180 + 193	C180									
194		87.8	123	303	170	41,600	347	302	192	92.8	188
195		40.5	53.7	144	77.4	15,300	166	157	95.7	47.0	108
196		49.3	63.9	157	91.3	19,200	195	150	120	53.4	115
197	197 + 200	10.4 C	9.36 C	20.6 C	17.5 C	4,050 C	54.2 C	32.7 C	30.0 C	12.5 C	29.6 C
198	198 + 199	111 C	135 C	296 C	201 C	42,100 C	409 C	371 C	295 C	132 C	265 C
199	198 + 199	C198									
200	197 + 200	C197									
201		20.8	21.6	52.1	32.2	4,580	58.8	61.9	45.5	19.5	40.5
202		31.8	33.5	79.3	64.5	7,230	141	138	84.3	40.9	109
203		79.9	98.5	227	157	23,500	314	270	203	88.0	247
204		0.194 J	0.213 EMPC	0.566 EMPC	0.276 J	17.5 U	0.629 J	0.515 J	0.543 J	0.262 EMPC	0.596 J
205		4.24	5.95	14.9	7.36	1,900	23.7	15.1	11.2	5.29	12.3
206		32.9	44.5	95.7	61.8	9,020	112	100	72.7	35.4	84.5
207		9.25	12.2	26.6	16.4	1,510 J	22.0	26.3	19.8	9.26	19.5
208		14.4	16.8	36.5	23.6	2,220	43.3	43.6	31.4	16.8	31.8
209		23.0	29.6	60.3	34.5	1,060 J	49.7	57.1	46.9	26.0	46.9

Maximum Detected Concentration	1,930 C	2,750 C	15,200 C	5,140 C	8,130,000	28,400 C	8,970 C	5,170 C	2,730 C	6,220 C	Total PCB SLV
Minimum Detected Concentration	0.0760 J	0.0710 J	0.112 J	0.0860 J	30.7 J	0.155 J	0.0850 J	0.0720 J	0.0810 J	0.0960 J	pg/g
Total of Detected Concentrations	13,219 J	14,633 J	106,339 J	35,481 J	69,271,672 J	277,333 J	51,588 J	35,991 J	17,985 J	39,743 J	570

**Notes:**

C = Concentration represents coeluting congeners.

U = The analyte was not detected above the RDL.

J = The reported value is an estimate.

UJ = The analyte was not detected. The RDL is an estimate.

ng/kg = nanogram/kilogram

pg/g = picograms/gram

EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.

<sup>1</sup>= When two or more congeners can not be resolved in the chromatogram they are considered to be 'coeluting' and are reported as a single concentration. This concentration is reported once for all the coeluting congeners.

RDL = Reported detection limit

## **Appendix B: Implementation Plan**

## **Bradford Island Fish Sampling 2020 Implementation Plan**

August 14, 2020

### **Background**

Bonneville Dam was authorized by the Flood Control Act adopted June 28, 1938 (Public Law No. 761, House Resolution No. 10618) and was the first dam constructed on the Columbia River. The site is a multipurpose facility that consists of the first and second powerhouses, old and new navigation locks, and spillway. Historical disposal practices resulted in electric equipment and other waste being placed in the river on the north shore of Bradford Island (Figure 1), including transformers containing PCB oil. In 2012, a Remedial Investigation (RI) report was completed (URS 2012) which summarized previous investigation activities that had taken place over the previous 10 years and used the data collected to identify source areas at Bradford Island, define the nature and extent of environmental contamination, and identify the contaminants of potential concern for human health and ecological receptors. The 2012 Remedial Investigation reported results from smallmouth bass and crayfish collected in 2008 and 2011, with elevated levels of PCBs in some fish and crayfish. Based on the length of time since previous fish sampling, and given the 2018 Solid Phase Microextraction (SPME) results from the site, the U.S. Army Corps of Engineers (USACE) believes more current fish tissue sampling and tracking is needed to help inform and update the conceptual site model for the River OU. The USACE has contracted with the U.S. Geological Survey (USGS) to collect crayfish and smallmouth bass samples and evaluate the movements of smallmouth bass near Bonneville Dam using acoustic telemetry. This study is in support of a broader effort being conducted by USACE under the Comprehensive Environmental Response, Compensation, and Liability Act at Bradford Island. This document is an implementation plan that describes planned field activities for the 2020 study.

### **Implementation Methods**

#### *Fish collection for tissue analysis*

The USACE is planning to conduct tissue analyses on smallmouth bass, crayfish, and clams to determine if contamination persists for organisms living in the vicinity of Bradford Island. USGS has been tasked with collecting smallmouth bass and crayfish for this effort. Sampling is planned for August and September 2020 and will occur within the River Operable Unit (OU) at Bonneville Dam and for crayfish at an upstream Reference Area located near Stevenson, Washington (Figure 1). Smallmouth bass will be collected by angling and crayfish will be collected using baited traps. A total of 80 smallmouth bass and 120 crayfish are desired for tissue sampling (Table 1). For crayfish, a composite of 3 individuals are desired from each collection site resulting in 20 collection sites required within each of the River OU and Reference Area locations (40 collection sites in total).

The spillway at Bonneville Dam is scheduled to be in operation until September 1, 2020, which precludes the use of boats to access areas immediately upstream of the spillway within the boat-restricted zone (BRZ) until spill is terminated. USGS will work closely with the USACE to obtain necessary permission and access credentials to operate within the BRZ as required to complete contracted activities during the study, and to identify desired sampling dates. It may be

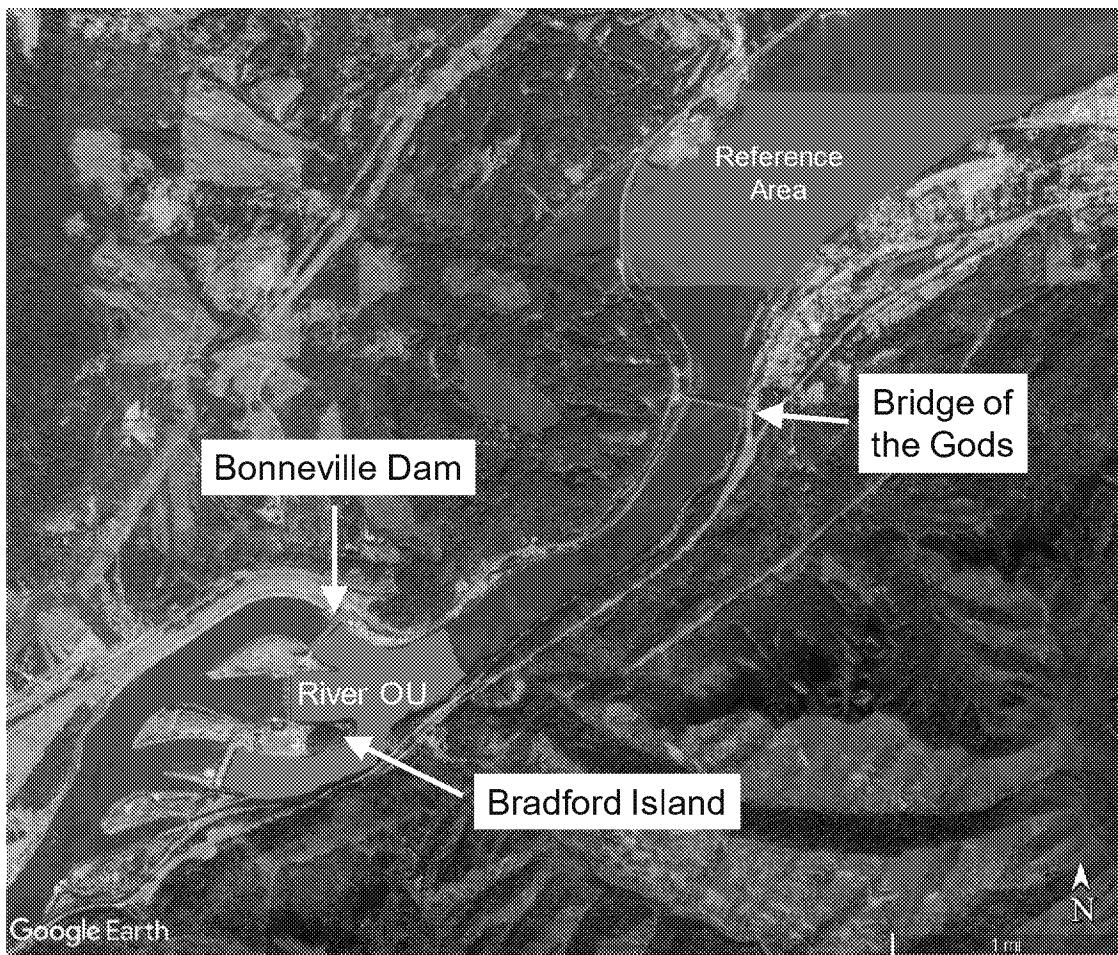


Figure 1. Image showing Bonneville Dam, Bradford Island, Bridge of the Gods, River Operable Unit (River OU) and Reference Area.

Table 1. Target number of smallmouth bass and crayfish to be collected for tissue sampling and for an acoustic telemetry study near Bonneville Dam, 2020.

Species	Sampling location	Purpose	Number required
Smallmouth bass	River OU/Reference	Tissue sampling	80
Crayfish	River OU	Tissue sampling	60*
Crayfish	Reference Area	Tissue sampling	60*

\*A composite of 3 crayfish are desired from each collection site, with 20 collection sites required at each of the River OU and Reference Area sampling locations. A total of 20 analytical composites will be collected from the River OU and the Reference Area.

possible to conduct sampling efforts in the River OU using shore-based methods and to collect samples in the Reference Area prior to September 1. These details will be addressed in the coming months between USGS and the USACE.

Angling for smallmouth bass will occur using two-person teams from USGS who may be accompanied by at least one USACE representative to assist with fish processing for tissue chemical analysis immediately following capture. Anglers will use lures or bait to collect smallmouth bass from within the River OU and the Reference Area (Figures 2 and 3). Non-target species collected by anglers will be immediately released at the capture location. The target sampling area within the River OU was chosen based on locations where bass were successfully caught in the past and are intended to be used as guidance for help in identifying locations to successfully catch bass. An effort will be made to focus fishing effort on priority areas identified in the QAPP and in Figure 2.

At the time of collection, individual fish will be immediately euthanized using the club method described in EPA (2000), externally marked for individual identification with a unique identification number, measured for fork length to the nearest centimeter, and placed in a cooler with ice. Additionally, latitude and longitude of the collection site will be recorded for each fish. A USACE representative will take possession of collected smallmouth bass immediately, if present, or at the end of each angling day. USGS may request permission to conduct a limited set of catch-and-release test fishing events to identify areas where smallmouth bass are congregated and to determine if a particular bait or lure are more effective than others at sampling near Bonneville Dam.

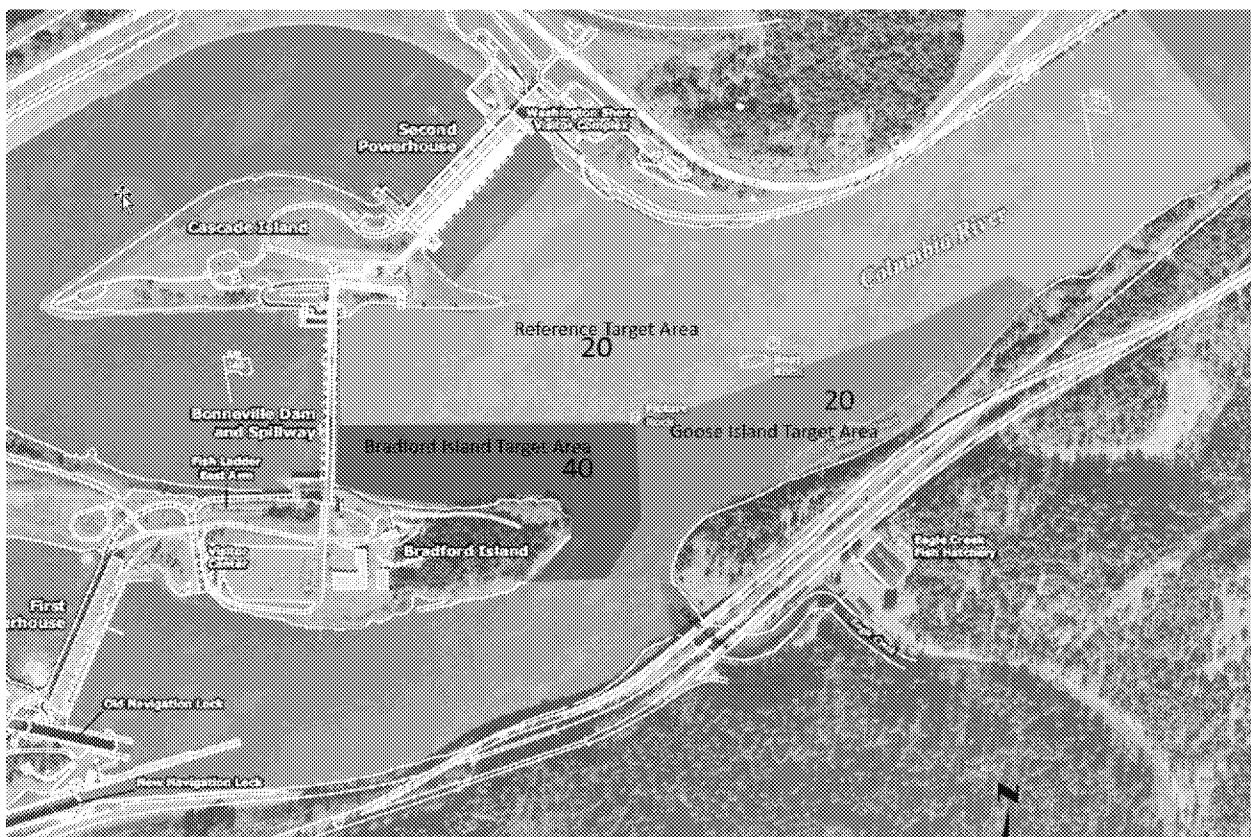


Figure 2. Bass Sampling Target Areas – River OU

Crayfish will be collected using baited traps that will be deployed in pre-determined zones of interest within the River OU and from the Reference Area (Figures 4 and 5). The target sampling areas within the River OU and by the Reference Area were chosen based on locations where crayfish were successfully caught in the past. For the reference area, the locations were identified with the effort to avoid potential point source contamination for the upland. Crayfish sampling will likely occur at the same time as smallmouth bass angling. Traps will be deployed at the start of each day and allowed to fish while staff focus on smallmouth bass sampling during the day. Traps will then be retrieved at the end of each day, and if collection numbers aren't sufficient to meet targets at a specific site, redeployed and allowed to fish overnight. Crayfish will be euthanized, measured, uniquely identified, and transferred to a USACE representative. At the conclusion of the study, results from collection efforts will be summarized, along with catch-per-unit-effort (CPUE) estimates and compiled in a USGS Open-file Report Series that is peer-reviewed and publicly available online.

USGS staff working on this study have an extensive history of fish sampling experience. Please use the following links to review examples of previous research involving fish sampling:

<https://www.cbfish.org/Document.mvc/Viewer/P129624>

<https://www.cbfish.org/Document.mvc/Viewer/P129628>

<https://pubs.usgs.gov/of/2019/1011/ofr20191011.pdf>

<https://pubs.usgs.gov/of/2019/1097/ofr20191097.pdf>

Crayfish Forebay Sampling Locations



Figure 4. Crayfish Sampling Target Areas – River OU

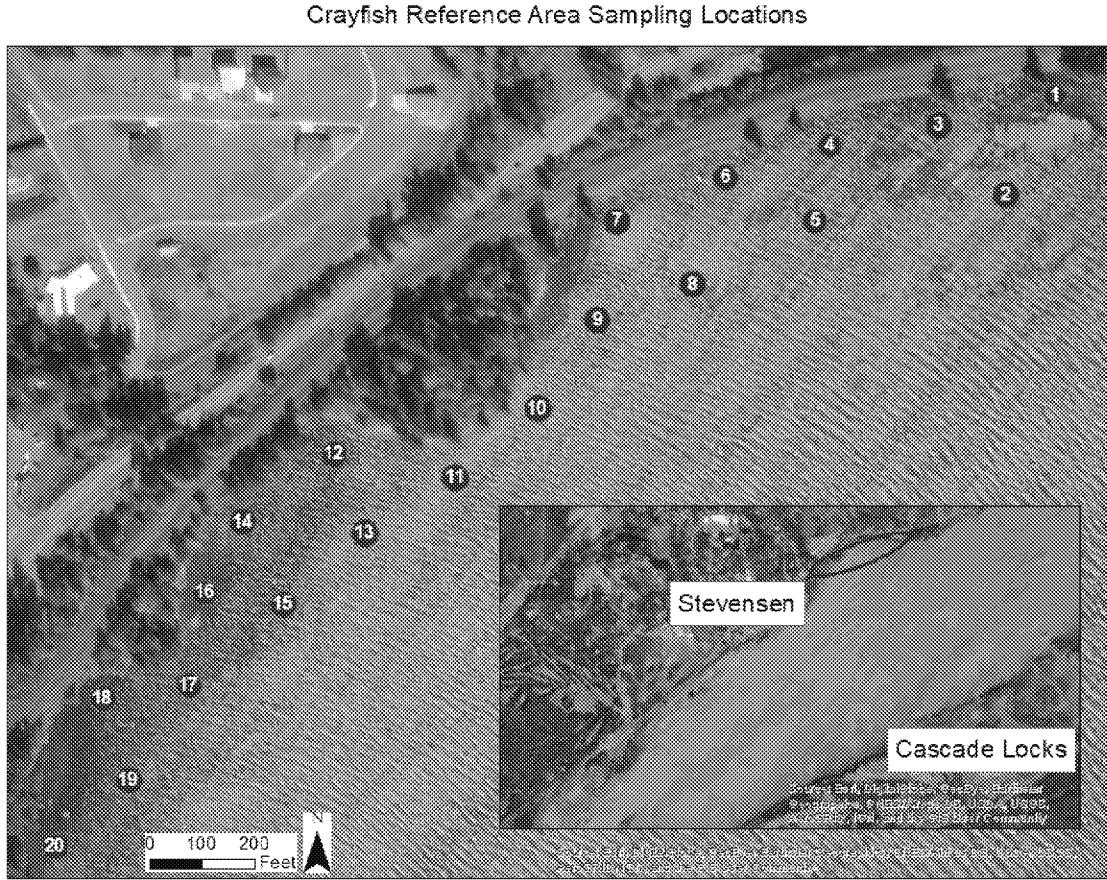


Figure 5. Crayfish Sampling Target Areas – Reference Area

#### *Acoustic telemetry study*

An acoustic telemetry study will be conducted during August–October 2020 to describe movement patterns of smallmouth bass near the forebay of Bonneville Dam. Fish will be tagged in August and September and transmitters will emit signals until late October when their batteries will expire. A total of 40 adult smallmouth bass (Table 2) will be collected using angling, surgically tagged with an acoustic transmitter (Model SS4000, Advanced Telemetry Systems, Isanti, MN), released, and monitored for approximately 90 days until the transmitters are expected to expire. Collection for acoustic tagging will occur simultaneously with collection for tissue analysis so collection methods will be identical to those previously described in this document except that we will also record the transmitter identification for each fish that is tagged and released. We will likely use two boats during this period with one boat focusing on collecting fish for tissue analyses and one boat focusing on collecting fish for acoustic tagging. Collection of fish for tissue analysis is the higher priority of the two collection efforts so the second boat will be redirected to collect fish for tissue sampling if necessary. Fish will be selected for tagging to ensure that a range of fish sizes (20-40 cm) are included in the assessment. Surgical implantation of acoustic transmitters and fish handling and holding will

follow methods described in Cooke and Bunt (2001). Fish will be released once they recover from anesthesia, usually within 5 minutes of surgery completion. We are currently conducting a laboratory study at our facility that includes acoustic tagging of a total of 10 adult smallmouth bass and monitoring tag retention and survival for approximately 3 months as a quality assurance/quality control measure for the field study.

A total of 15 acoustic receivers (Model SR5000, Advanced Telemetry Systems, Isanti, MN) will be deployed prior to tagging and will operate continuously throughout the study period. Most receivers will be concentrated within 2.5 km of the Bonneville Dam forebay to detect fish moving near the dam (Figure 6). Two additional receivers will be deployed approximately 4.5 km upstream of the dam to determine if smallmouth bass undertake substantial upstream movements away from Bonneville Dam. Acoustic receivers can reliably detect tagged fish that are located within approximately 100 m of the receiver location, so this array was designed to maximize detection probability (>95%) of tagged fish near Bonneville Dam and is based on a long history of conducting telemetry studies including multiple studies near Bonneville Dam. Receivers will continuously monitor for the presence of tagged fish and will record the date and time of each detection (transmitters will emit a signal every 5 sec). This ping rate was selected to ensure an accurate measure of fish transiting certain zones within the forebay. Sites will be visited one time per week by a USGS employee to check on the operational status of the receiver and to download data until all tags have stopped operating.<sup>1</sup>

Table 2. Target number of smallmouth bass and crayfish to be collected and tagged for an acoustic telemetry study near Bonneville Dam, 2020.

Species	Sampling location	Purpose	Number required
Smallmouth bass	River OU	Acoustic telemetry	40

At the conclusion of the study, telemetry records will be analyzed, and fish movement patterns will be summarized to describe the following:

- (1) Residence time near Bradford Island. Telemetry records will be queried to determine the total amount of time that tagged individuals were detected on receivers located on Bradford Island (Receivers 2, 3 and 6; Figure 6). This information will be useful for understanding temporal exposure of smallmouth bass to conditions around Bradford Island.
- (2) Movement between Bradford Island and other areas of the Bonneville Dam forebay. Telemetry records will be queried to determine the number of fish that move between receivers located on Bradford Island and other locations in the forebay of Bonneville Dam including the southern shoreline (Receivers 1, 7, 8 and 11; Figure 6), northern shoreline (Receivers 10 and 12; Figure 6), Boat Rock (Receiver 9; Figure 6), and Cascades Island (Receivers 4 and 5; Figure 6). This information will be useful for understanding how smallmouth bass move within the forebay of Bonneville Dam and for making inferences about how the near-dam population is exposed to conditions around Bradford Island.

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<sup>1</sup>Acoustic telemetry studies are frequently conducted using site visits every 3 weeks so the approach outlined is more robust.

(3) Movement between the forebay of Bonneville Dam and sites located approximately 4.5 km upstream of the dam. Telemetry records will be queried to determine if any fish move upstream from the forebay of Bonneville Dam and are detected on acoustic receivers located near the downstream end of the Reference Area. This information will be useful for understanding if large movements by smallmouth bass occur during late summer and fall.

Telemetry results will be summarized in a USGS Open-file Report Series that is peer-reviewed and publicly available online. USGS staff working on this project have extensive experience in conducting active telemetry studies. Examples of previous telemetry research can be accessed using the following links:

<https://pubs.usgs.gov/of/2014/1069/>

<https://onlinelibrary.wiley.com/doi/full/10.1002/rra.3023>

<https://pubs.usgs.gov/of/2016/1210/ofr20161210.pdf>

#### *Health and safety plan*

USGS takes workplace safety seriously and has the following Occupational Safety and Health Program Requirements:

<https://www.usgs.gov/about/organization/science-support/survey-manual/445-2-h-occupational-safety-and-health-program>

All USGS employees working on this project have up-to-date certifications for first aid, and are certified motorboat operators through the Motorboat Operator Certification Course. Our employees are currently conducting fieldwork while taking approved precautions for minimizing the likelihood of acquiring or transmitting COVID-19. These precautions include traveling in separate vehicles to field sites, having no more than 2 people present on a boat at any one time, wearing a mask, maintaining adequate social distancing and frequently washing hands. Our precautions have changed frequently as this situation has evolved and we expect it to continue evolving as the study proceeds. The USACE and USGS will communicate frequently to ensure consistency in evolving procedures to protect against the spread of COVID-19. All field staff will be required to stay home if not feeling well. Backup staff will be available from both USGS and USACE in the event that any staff need to stay home sick.

Additionally, the USACE has specific safety requirements for working at or near the dam. USGS will comply with these requirements, including acquiring a BRZ permit.



Figure 6. Image showing proposed locations of acoustic receivers (numbered small circles) near the forebay of Bonneville Dam for monitoring movements of acoustic-tagged smallmouth bass during August–October 2020.

#### *Schedule*

Table 2. Activity schedule for various elements of the study.

Description	Period or due date
Consult with USACE to establish target sampling dates, revise protocols, and secure permission and credentials required to access areas for sampling and deploying acoustic telemetry monitoring sites.	June 1–July 15, 2020
Potential catch-and-release test fishing events.	June 15–July 15, 2020
Install acoustic telemetry monitoring sites.	July 15–July 30, 2020
Field sampling to collect smallmouth bass and crayfish for tissue analyses.	August 3–September 30, 2020

Field sampling to collect smallmouth bass for acoustic tagging. Acoustic telemetry sites in operation.	August 3–31, 2020 August 3–October 31, 2020
Remove all acoustic telemetry sites. Data analysis, reporting.	November 1–13, 2020 November 1–December 30, 2020
Draft report due.	December 31, 2020
Final report due.	April 30, 2021

## References

Cooke, S.J., and C.M. Bunt. 2001. Assessment of internal and external antenna configurations of radio transmitters implanted in smallmouth bass. North American Journal of Fisheries Management 21: 236-241.

EPA. 2000. Guidance for assessing chemical contamination data for use in fish advisories. Volume 1: Fish sampling and analysis, 3<sup>rd</sup> edition. EPA 823-B-00-007. Office of Water, US Environmental Protection Agency, Washington, DC available at <https://www.epa.gov/sites/production/files/2018-11/documents/guidance-assess-chemical-contaminant-vol1-third-edition.pdf>

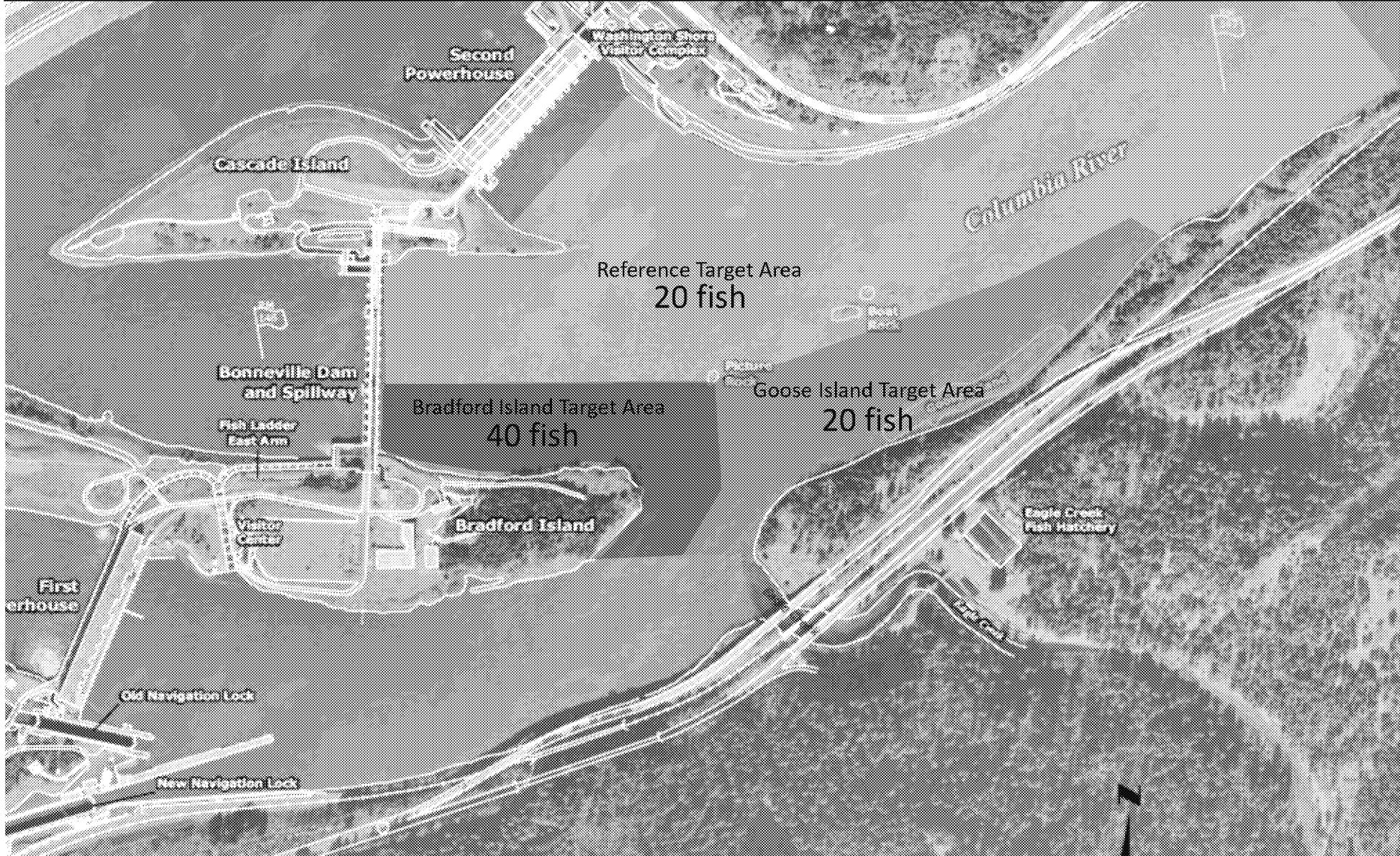
URS. 2012. Upland and River Operable Units Remedial Investigation Report. Bradford Island, Bonneville Dam Forebay, Cascade Locks, Oregon. June.

URS. 2016. Baseline human health and ecological risk assessment, river operable unit. Report to the U.S. Army Corps of Engineers, Portland, Oregon. April 2016. 88 p.

USACE. 2017. Final feasibility study: Bradford Island upland operable unit, Cascade Locks, Oregon. Report by the U.S. Army Corps of Engineers, Portland, Oregon. August 2017. 136 p.

## **Appendix C: Maps**

# Bass Sampling Target Collection Areas – Site/Reference



## Crayfish Forebay Sampling Locations



ED\_005082\_00020171-00077

## Crayfish Reference Area Sampling Locations



## **Appendix D: Statistical Analysis**

## **APPENDIX D. Development of Power Curves for Bradford Island Fish Sampling Program**

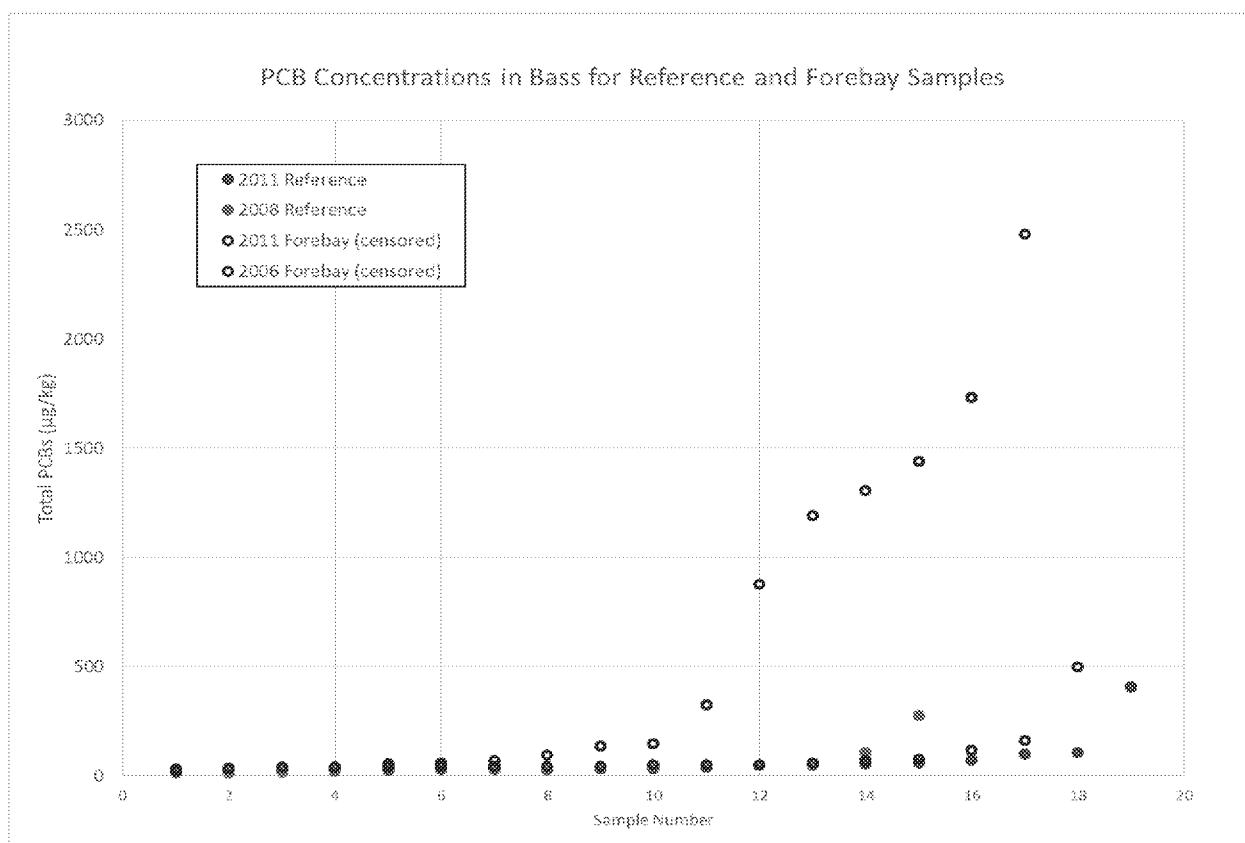
In support of the study design for the fish tissue sampling for Smallmouth bass, historical data from Forebay and Reference area were used to generate power curves. The power curves provide a basis for determining the number of samples that will be needed to compare the Forebay to a reference condition (whether that be a reference area mean or a comparison value). Note that in the current design, each data point will represent a single, whole fish.

Historical data for Total PCBs from the 2011 fish sampling effort and from the 2006 and 2008 sampling effort were used to provide input data for the power analysis. This included the mean, standard deviation (SD), and sample numbers (n) (Table 1). The complete data sets were used from the reference area. The Forebay datasets from both 2006 and 2011 included data points that were extremely high (>19,000 µg/kg Total PCBs). These data points were considered outliers and were removed from the data set for the purposes of this analysis, since the variability would result in very high estimates of standard error and very low estimates of power. If these high concentrations are still present in fish tissue, decisions are not likely to be made based on statistical analysis. Summary statistics are presented in Table 1. The distribution of Total PCB tissue concentrations for each of the data sets is presented in Figure 1.

**Table 1. Data Sets Used for Power Curves**

Location	Year	Mean (µg/kg Total PCBs)	SD	n	Range (µg/kg Total PCBs)
Reference	2011	63	87	19	17-407
Reference	2008	82	106	19	22-499
Forebay Censored	2011	55	65	13	13-277
Forebay Censored	2006	593	764	17	32-2482
2011 Reference and Forebay Censored Combined	2011	60	77	34	13-407
Forebay Combined High Values Censored	2006 - 2011	341	614	32	13-2482

- Censored values have highest values removed (all values >19,000 µg/kg)



*Figure 1. Distribution of Reference and Forebay Data Used in Power Analysis*

For the purposes of the upcoming sampling, two power curves were generated. The first was intended to support a comparison between the Forebay and Reference. The second was to represent a more variable data set in the Forebay compared to a threshold concentration.

### **Scenario 1: Forebay 1 vs Reference**

The reference mean was based on the 2011 Reference data. The Reference area mean of 63 µg/kg is similar to the 2011 censored data set for the Forebay without the extremely high values (mean = 55 µg/kg; SD: 77 µg/kg).

The treatment mean for this scenario, Forebay 1, (100 µg/kg) was an estimated low-end value that we would need to distinguish from Reference. This would represent a condition where the fish tissue concentrations were similar to 2011 in the absence of the extremely high values observed in 2011. This estimated value was also the 95% UCL for the reference data indicating that the number of samples should be sufficient to distinguish between reference and a value above the 95% UCL (100 µg/kg).

The Standard Deviation (77 µg/kg) used in this scenario was based on the combined 2011 Reference and 2011 Forebay Censored dataset. There was substantial overlap of these two data sets that appear to represent the Reference condition and provided an estimate of variation for a population of 34 fish. While this dataset did include all fish from the reference area (e.g. one value of 407 µg/kg), it provided a conservative level of variation that might represent a future condition. In other words, the data is further processed to remove values certain values, the estimate of power might be overestimated and the number of samples needed might be underestimated.

#### ***Input Information for Curve 1:***

Hypothesis: Is mean PCB tissue concentration in Smallmouth bass from the Forebay significantly different from the Reference?

Reference Mean: 63 µg/kg (based on 2011 Reference data)

Forebay Mean: 100 µg/kg (estimated value; 2011 Reference 95% UCL)

Standard Deviation: 77 µg/kg (based on 2011 Forebay data set w/o 4 points (>30,000 µg/kg))

Alpha = 0.05

#### **Scenario 2: Forebay 2 vs Reference**

The reference mean for this scenario was based on the 2011 Reference data and was the same value used in Scenario 1.

For this scenario, the Forebay 2 mean (341 µg/kg) and standard deviation (614 µg/kg) were based on Total PCB concentrations from the Forebay in 2006 and 2011, with the highest values (>19,000 µg/kg) removed. This data provided higher mean and standard deviation scenario, and might represent a future Forebay data set that includes intermediately elevated fish tissue concentrations (500 to 5,000 µg/kg PCB).

#### ***Input Information for Curve 2:***

Hypothesis: Is mean PCB tissue concentration in Smallmouth bass from the Forebay significantly different from the Reference?

Reference Mean: 63 µg/kg (based on 2011 Reference Mean)

Forebay Mean: 341 µg/kg (combined 2006/2011 Forebay data without six points (>19,000 µg/kg))

Standard Deviation: 614 µg/kg (based on combined 2006 and 2011 Forebay data set without six points (>19,000 µg/kg))

Alpha = 0.05

### **Curve 3: Forebay vs Critical Value**

A critical tissue value as a point of reference has been proposed in lieu of using a reference-based sample. For the purpose of this power analysis, the critical tissue value was 100 µg/kg, based on a No Observed Adverse Effects Level proposed by USFWS. The value that is ultimately used for the site may differ.

For this power curve, the Forebay mean (341 µg/kg) and standard deviation (614 µg/kg) were based on Total PCB concentrations from the Forebay in 2006 and 2011, with the highest values (>19,000 µg/kg) removed. This data provided higher mean and standard deviation, and might represent a future Forebay data set that includes intermediately elevated fish tissue concentrations (500 to 5,000 µg/kg Total PCBs).

#### ***Input Information for Curve 3:***

Hypothesis: is mean in Forebay significantly different from a Threshold of 100 µg/kg.

Historical Mean: 100 µg/kg (based on 2011 Reference mean)

Forebay Mean: 341 µg/kg (based on combined 2006 and 2011 Forebay mean without six points (>19,000 µg/kg))

Standard Deviation: 614 µg/kg (based on combined 2006 and 2011 Forebay mean without six points (>19,000 µg/kg))

Alpha = 0.05

The three power curves are shown on Figure 2. The power curves show the number of samples (along the x-axis) that would be needed to achieve different levels of power (along y-axis) for each scenario presented above. Based on the current sampling design of 40 samples in the Forebay, the power for the three scenarios ranges from approximately 80 to 93%. For comparisons to a reference mean of 63 µg/kg, the proposed sample number should be sufficient to support statistical comparison of the Forebay and reference population. For a comparison to a threshold value of 100 µg/kg, increasing the sample number to 50 to 60 samples would provide more power. However, these curves were generated based on a two-way comparison and a comparison to a threshold value would likely be conducted as a one-way comparison. The current sample estimate should be a conservative estimate of sample number for a one-way comparison.

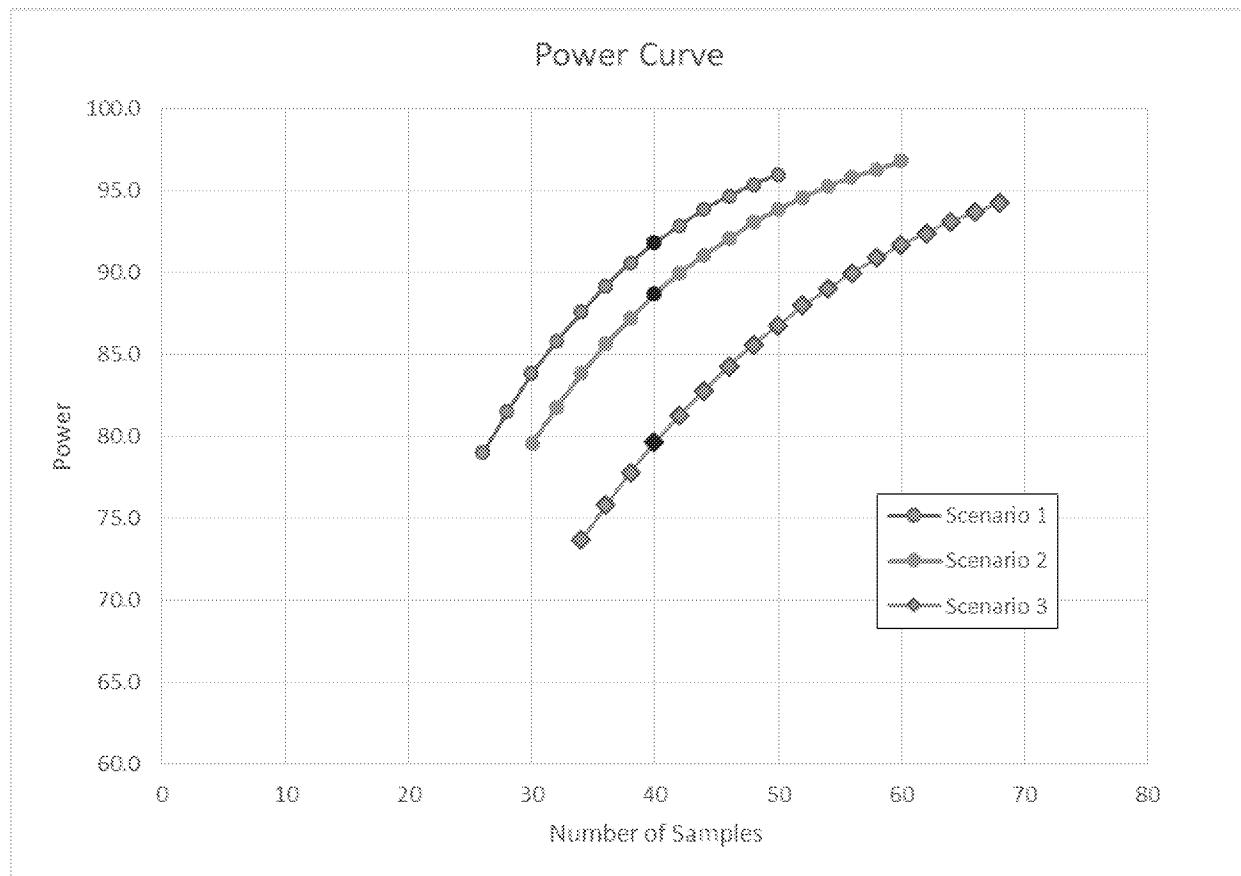
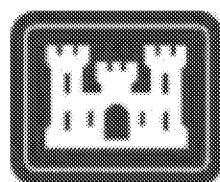


Figure 2. Power Curves for Smallmouth Bass at the Forebay.

## **Appendix E: Field Forms**

**Field Form (to be completed by USGS or USACE staff)**  
**Project: Bradford Island River OU Bass and Crayfish Sampling**

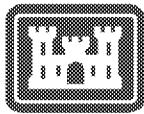


**Boat:**

Date:

Sampler's Name:

## **Appendix F: Job Hazard Analysis (JHA)**



**U.S. ARMY CORPS OF ENGINEERS, SEATTLE DISTRICT  
ACTIVITY HAZARDS ANALYSIS (AHA)**

For use of this form, see EM 385-1-1 Section 01.A.15; the proponent agency is CENWS-SO

Date Prepared: 20 July 2020

Overall Risk Assessment Code (RAC)  
(Use highest final RAC)

M

Project/Location: Bonneville Dam, Cascade Locks, Oregon

Activity/Work Task: Bradford Island River OU Bass Sampling

Contract Number: NA

Prepared By (Name & Title): Katie Richwine/ Joseph Marsh CDSO

Reviewed By (Name & Title): Joseph Marsh, Collateral Duty Safety Officer

E = Extremely High Risk  
H = High Risk  
M = Moderate Risk  
L = Low Risk

Severity

**Risk Assessment Code \* (RAC) Matrix**

		Probability				
		Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M	M
Critical	E	H	H	M	L	L
Marginal	H	M	M	L	L	
Negligible	M	L	L	L	L	

**USACE Risk Acceptance Authority** (digital signature):

[For Acceptance of Risk Authority see Table 4-2, DA PAM 385-30, Risk Management]

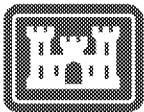
MARSHJOSEPH.R.1201777662

Digitally signed by MARSHJOSEPH.R.1201777662

Date: 2020.07.19 14:17:09 -07'00'

Add Identified Hazards

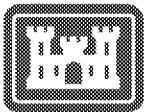
Job Steps	Hazards	Initial RAC *	Actions To Eliminate or Minimize Hazards		Final RAC *
1. Overall Project Execution.	Potential COVID19 exposure.	M	<p>Face coverings are mandatory for employees, inside (unless working alone) and outside, when 6ft distancing from other individuals cannot be maintained.</p> <p>Face covers must be worn in meeting type situations - regardless of separation. Social distance of 6-ft or greater must be maintained and no more than 10-people gathered together.</p> <p>Face coverings are required to be worn at all time when traveling or operating a vehicle, vessel or equipment with more than one occupant/operator.</p> <p>Disinfectant wipes (or similar) used prior to and after each use of a shared piece of equipment.</p>	L	



U.S. ARMY CORPS OF ENGINEERS, SEATTLE DISTRICT  
**ACTIVITY HAZARDS ANALYSIS (AHA)**

For use of this form, see EM 385-1-1 Section 01.A.15; the proponent agency is CENWS-SO

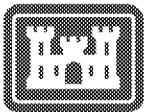
Job Steps	Hazards	Initial RAC*	Actions To Eliminate or Minimize Hazards	Final RAC*
2. GOV / POV Vehicle Usage - Based on round trip. Prior to usage, en transit and stoppages, and return of vehicle.  Note: Cleaning supplies can be obtained from the District Headquarters POC: Chris Garcia 206-764-3663(office) 206-406-6216(cell)	Exposure to potential COVID19 droplets on vehicle surface  Exposure to individuals with potential to have COVID19  Exposure to surface with potential COVID19 droplets outside of vehicle.	M	Wipe down inside of vehicle with CDC/EPA approved disinfectant before use and after usage.  Wear PPE specified by manufacturer of disinfectant. This could include Nitrile gloves, eye protection, etc.  Wash or sanitize hands after disinfecting vehicle  To maintain social distancing of 6 feet, limit capacity to 1 person per vehicle. If unable to accommodate 1 person per vehicle, have the driver and passenger in the opposite rear passenger seat.  Maintain social distancing of 6 feet for interactions outside of vehicle.  Utilizing drive through, self-checkouts at grocery stores, and pay at the pump stations for fuel to minimize social contact with individuals.  Research sites before travel to determine breaks in route with adequate hand washing facilities.  Wash hands frequently while outside of vehicle. Refrain from shaking hands and avoid contact with sick individuals.  Reduce need to minimize stops by bringing food and water from home.  Wash hands or sanitize before re-entering the vehicle.  If possible, do not hand over identification for someone else to touch. If handing over is required, and disinfect id card and hands after ID card is returned.  Minimize social contact by lowering the window the minimal amount necessary.	M



U.S. ARMY CORPS OF ENGINEERS, SEATTLE DISTRICT  
**ACTIVITY HAZARDS ANALYSIS (AHA)**

For use of this form, see EM 385-1-1 Section 01.A.15; the proponent agency is CENWS-SO

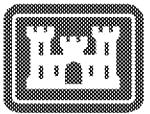
Job Steps	Hazards	Initial RAC*	Actions To Eliminate or Minimize Hazards	Final RAC*
	Exposure to other individuals in vehicle	M	To maintain social distancing of 6 feet, limit capacity to 1 person per vehicle. If unable to accommodate 1 person per vehicle, have the driver and passenger in the opposite rear passenger seat.	L
3. Prepare sampling equipment; sampling site access and setup.	Slips, trips, falls. Hand injuries. Pinch points. Lifting related injuries from loading/unloading vehicles. Carrying heavy sample coolers and equipment. Heat stress; sunburn; chemical exposure.	M	<p>Wear leather work gloves when handling tools or materials that may be sharp or have sharp edges. Be familiar with the proper use and limitations of hand tools.</p> <p>Maintain steady pace and follow rest periods given on job. Select a position during hand clearing to minimize following stressors: chronic muscle contraction or steady force; extreme or awkward positions; repetitive forceful motions; or excessive gripping, pinching, or pressing.</p> <p>Do not twist and turn while lifting.</p> <p>Keep the load centered and close to body.</p> <p>Report even minor injuries to site supervisor for evaluation.</p> <ul style="list-style-type: none"><li>Have a first aid kit available and have a minimum of 2 persons with first aid and CPR training on-site. Walk carefully.</li><li>Wear clothing appropriate for the weather, including a hat. Wear sunscreen as needed. Pay attention to river stage, sequence sampling activities to avoid inundation. Wear appropriate PPE.</li><li>No eating, drinking, etc. while collecting samples. Always use buddy system. Wear safety toe boots during fieldwork in accordance with ASTM F2413-18.</li><li>All personnel must wear PFD while working on a boat or within 6 feet from shoreline.</li></ul>	L



U.S. ARMY CORPS OF ENGINEERS, SEATTLE DISTRICT  
**ACTIVITY HAZARDS ANALYSIS (AHA)**

For use of this form, see EM 385-1-1 Section 01.A.15; the proponent agency is CENWS-SO

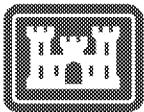
Job Steps	Hazards	Initial RAC*	Actions To Eliminate or Minimize Hazards	Final RAC*
3. Collection of bass samples: assisting the USGS team from a boat platform and/or the shoreline.	Cold water contact, drowning, slips, trips, and falls; back strain - muscle strain; heat stress, sunburn, cold stress, precipitation, biological hazards, lightening - visibility.	L	Remain alert for work site hazards. 3 points of contact when moving around boat. BRZ permit, coordination with dam control room, and current HECP training when entering forebay. Use buddy system - no personnel permitted to work alone. Use sampling tools designed to minimize back/muscle strain during work. Wear clothing appropriate for the weather and work tasks (Level D). Wear sunscreen as needed. Wear appropriate PPE to include Nitrile gloves, steel toed boots, and eye protection. No eating, drinking, etc. while collecting samples. Inspect work sites for biological hazards before starting work. Only perform work during daylight hours. Follow Site Specific H&S Plan for Bonneville Dam. In event of emergency, call radio control room (do not call 911).	L
3a. Collection of bass samples continued... Decontamination of equipment and PPE.	Slips, trips, and falls.	M	Use buddy system. Give self enough time to decontaminate PPE and equipment. Consider using disposable PPE or equipment for difficult to decontaminate items. Wear appropriate PPE and use good technique when removing PPE. Properly dispose of used/soiled waste materials.	L
3b. Collection of bass samples continued...	Heat Stress.	M	5e. When hot/humid conditions are forecast for the project site, the site safety and health officer (SSHO) shall: brief signs, symptoms and first aid procedures for heat stress. Schedule work earlier or later in the day. Use work/rest schedules. Limit strenuous work (e.g., carrying heavy loads). Use relief workers when needed. Use buddy system to monitor team member symptoms. Field workers shall ensure sufficient drinking water is available at all times.	L



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**ACTIVITY HAZARDS ANALYSIS (AHA)**

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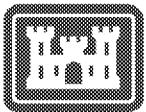
Job Steps	Hazards	Initial RAC*	Actions To Eliminate or Minimize Hazards	Final RAC*
3c. Collection of bass samples continued...	Cold Stress/hypothermia.	M	5f. In the event of forecast cold weather or wind chill warnings, the SSHO shall brief cold stress symptoms, monitoring, and first aid procedures. Use buddy system to monitor team member symptoms. Team leader shall ensure personnel wear appropriate PPE for cold weather, and establish warming breaks in heated vehicles or buildings as appropriate.	L
3d. Collection of bass samples continued...	Severe weather: Storms and lightning.	M	5g. If lightning is observed during fieldwork, and thunder is heard within 30 seconds, cease operations immediately and seek shelter. Work may resume 30 minutes after the last observed lightning strike. Personnel should monitor weather regularly by vehicle radio, or smartphone weather apps. Work will cease in the event of severe rainstorms, reported tornadoes in area, snowstorms, hail, and high winds.	L



U.S. ARMY CORPS OF ENGINEERS, SEATTLE DISTRICT  
**ACTIVITY HAZARDS ANALYSIS (AHA)**

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Job Steps	Hazards	Initial RAC*	Actions To Eliminate or Minimize Hazards	Final RAC*
4. Boat Operations - sampling from boat - small vessel 26 feet or under.	Drowning, falling overboard, inclement weather, pinches, cuts, laceration, COVID-19 Exposure.	M	<p>IAW Section 1 and 2 above: Cloth face coverings must be worn by all personnel on boat at all times. Sanitize hands and don required PPE listed in Equipment before boarding.</p> <p>Personnel shall sanitize all touch areas in spaces entered before departure. Maintain maximum amount of space possible between personnel. Avoid touching face.</p> <p>Operator must have valid motor boat operators permit. Do not exceed passenger or cargo limit on vessel. Make and use safety checklist.</p> <p>Operator to brief boat operations safety to all passengers before getting under way.</p> <p>Ensure approved PFD's are available and worn by all personnel on boat. Personnel should remain seated while boat is under way.</p> <p>Standing during work is approved if hand rails or structures are available to help prevent falls. Do not lean over side of boat. Use buddy system - personnel should not work alone.</p> <p>Ensure all safety devices first aid kits, fire extinguishers, etc.) are on board and in serviceable condition. Make sure audible signaling device is on board and serviceable (whistle or horn).</p>	L
5. General	Fire and Emergencies.	M	<p>First Aid Kits and fire extinguishers shall be loaded into field vehicle before departing for the project site.</p> <p>At least two fully charged cell phones will be available with field team at all times in case of fire or medical emergency (Call 911).</p> <p>SSHO will brief directions to hospital before work begins.</p> <p>At least one person with current First Aid/CPR training shall be present on site during the work. If possible, do not park vehicles on tall, dry grass.</p> <p>Only fight very small fires with fire extinguishers. Otherwise, for larger fires, safely depart site and call 911.</p>	L



U.S. ARMY CORPS OF ENGINEERS, SEATTLE DISTRICT  
**ACTIVITY HAZARDS ANALYSIS (AHA)**

For use of this form, see EM 385-1-1 Section 01.A.15; the proponent agency is CENWS-SO

Equipment	Training	Inspection
Add Items		

Equipment	Training	Inspection
Hand sanitizer if hand washing facilities are not available	NA	NA
CDC/EPA-approved Disinfectant	NA	NA
PPE recommended by manufacturer of specific CDC/EPA-approved disinfectant used	Varies depending on PPE	Varies depending on PPE.
Ensure that you are wearing the proper PPE - PFD's, Hard Hat, Steel Toed Boots, Safety Vest, Safety Glasses and Gloves. Be sure to check with site POC to verify PPE requirements.	Varies depending on PPE	Varies depending on PPE
Motor Vehicle	Defensive Drivers Certificate/boat operators license.	Daily
Check for READY condition of vehicles, cell phone batteries, first aid kits, fire extinguisher, eye wash bottles, PPE, sampling equipment, drinking water, decontamination water, sanitation and hand wash facilities.	Current HAZWOPER training/refresher for all field employees, at least one person trained and current in First Aid/CPR, site specific training, equipment and procedures training, daily tailgate safety briefings.	Daily vehicle inspection. Continuous site observation for identified hazards. Daily inspection of PPE, sampling equipment (pump equipment and air lines), and tools.

Add Name
----------

**Involved Personnel (Initial & Date Beside Name)**

Initial	Date

Add Competent Person
----------------------

Competent Person	Area of Competency

## **Appendix G: ERDC 153 PCB Congeners with Detection Limits and Reporting Limits**

## Appendix G. PCB Congeners and Laboratory Limits

ERDC list of 153 PCB congeners analyzed by modified EPA method 8082, with reporting limits (RLs) and detection limits (DLs).

Analyte	RL (ug/kg)	DL (ug/kg)	Notes
PCB 1	0.2	0.015	
PCB 10	0.1	0.075	
PCB 100/67	0.2	0.015	Co-eluters
PCB 101/90	0.2	0.015	Co-eluters
PCB 103	0.1	0.075	
PCB 104	0.1	0.075	
PCB 105	0.1	0.075	
PCB 107	0.1	0.075	
PCB 110	0.1	0.075	
PCB 114	0.1	0.075	
PCB 115/87	0.2	0.015	Co-eluters
PCB 117/81	0.2	0.015	Co-eluters
PCB 118	0.1	0.075	
PCB 119	0.1	0.075	
PCB 12	0.1	0.075	
PCB 121	0.1	0.075	
PCB 122	0.1	0.075	
PCB 124	0.1	0.075	
PCB 126	0.1	0.075	
PCB 128	0.1	0.075	
PCB 129	0.1	0.075	
PCB 13	0.1	0.075	
PCB 130	0.1	0.075	
PCB 131	0.1	0.075	
PCB 132	0.1	0.075	
PCB 134	0.1	0.075	
PCB 135	0.1	0.075	
PCB 136	0.1	0.075	
PCB 137	0.1	0.075	
PCB 138/163/164	0.3	0.0225	Co-eluters
PCB 14	0.1	0.075	
PCB 141	0.1	0.075	
PCB 142	0.1	0.075	
PCB 144	0.1	0.075	
PCB 146	0.1	0.075	
PCB 147	0.1	0.075	
PCB 149/123	0.2	0.015	Co-eluters
PCB 15	0.1	0.075	
PCB 151	0.1	0.075	
PCB 153	0.1	0.075	
PCB 154	0.1	0.075	
PCB 155	0.1	0.075	
PCB 156	0.1	0.075	
PCB 157/201	0.2	0.015	Co-eluters
PCB 158	0.1	0.075	
PCB 16	0.1	0.075	

PCB 165	0.1	0.075	
PCB 167	0.1	0.075	
PCB 169	0.1	0.075	
PCB 17	0.1	0.075	
PCB 170/203	0.2	0.015	Co-eluters
PCB 171	0.1	0.075	
PCB 172	0.1	0.075	
PCB 173	0.1	0.075	
PCB 174	0.1	0.075	
PCB 175	0.1	0.075	
PCB 176	0.1	0.075	
PCB 177	0.1	0.075	
PCB 178	0.1	0.075	
PCB 179	0.1	0.075	
PCB 18	0.1	0.075	
PCB 180	0.1	0.075	
PCB 183	0.1	0.075	
PCB 184	0.1	0.075	
PCB 185	0.1	0.075	
PCB 187	0.1	0.075	
PCB 189	0.1	0.075	
PCB 19	0.1	0.075	
PCB 190	0.1	0.075	
PCB 191	0.1	0.075	
PCB 192	0.1	0.075	
PCB 193	0.1	0.075	
PCB 194	0.1	0.075	
PCB 195	0.1	0.075	
PCB 196	0.1	0.075	
PCB 197	0.1	0.075	
PCB 199	0.1	0.075	
PCB 200	0.1	0.075	
PCB 202	0.1	0.075	
PCB 204	0.1	0.075	
PCB 205	0.1	0.075	
PCB 206	0.1	0.075	
PCB 207	0.1	0.075	
PCB 208	0.1	0.075	
PCB 209	0.1	0.075	
PCB 22	0.1	0.075	
PCB 24 /27	0.2	0.015	Co-eluters
PCB 25	0.1	0.075	
PCB 26	0.1	0.075	
PCB 28/31	0.2	0.015	Co-eluters
PCB 29/54	0.2	0.015	Co-eluters
PCB 3	0.2	0.015	
PCB 32	0.1	0.075	
PCB 33/20	0.2	0.015	Co-eluters
PCB 34	0.1	0.075	
PCB 35	0.1	0.075	
PCB 36	0.1	0.075	
PCB 37	0.1	0.075	
PCB 4	0.1	0.075	

PCB 40/71	0.2	0.015	Co-eluters
PCB 41	0.1	0.075	
PCB 42	0.1	0.075	
PCB 44	0.1	0.075	
PCB 45	0.1	0.075	
PCB 46	0.1	0.075	
PCB 47/48/75	0.3	0.0225	Co-eluters
PCB 49	0.1	0.075	
PCB 5	0.1	0.075	
PCB 51	0.1	0.075	
PCB 52	0.1	0.075	
PCB 53	0.1	0.075	
PCB 56/60	0.2	0.015	Co-eluters
PCB 59	0.1	0.075	
PCB 6	0.1	0.075	
PCB 63	0.1	0.075	
PCB 64	0.1	0.075	
PCB 66/93	0.2	0.015	Co-eluters
PCB 69	0.1	0.075	
PCB 7	0.1	0.075	
PCB 70	0.1	0.075	
PCB 73	0.1	0.075	
PCB 74	0.1	0.075	
PCB 77	0.1	0.075	
PCB 78	0.1	0.075	
PCB 8	0.1	0.075	
PCB 82	0.1	0.075	
PCB 83	0.1	0.075	
PCB 84	0.1	0.075	
PCB 85	0.1	0.075	
PCB 9	0.1	0.075	
PCB 91	0.1	0.075	
PCB 92	0.1	0.075	
PCB 95	0.1	0.075	
PCB 97	0.1	0.075	
PCB 99	0.1	0.075	

## **Appendix H: Dry ice sample packing and shipping**

## **Instructions - How to Pack Sample Coolers for Shipment with Wet or Dry Ice**

### **At the sampling location:**

1. Samples should be iced as soon as they are sampled. Place the collected samples in a cooler with ice. Samples may be prepared for shipping at the sample location, or later at a convenient location, as long as samples are iced throughout.

### **When using wet ice – How to prepare the samples and cooler for shipment:**

1. So that leaks will not escape the cooler, seal the cooler drain with tape on the inside of the cooler, if it is not already sealed.
2. Line the bottom and sides of the cooler with thick bubble wrap.
3. Place a large, heavy-duty trash bag inside the cooler. All samples and ice will go inside this trash bag.
4. Double-bag ice inside gallon-sized Ziploc bags. Each cooler should have 4 to 5 bags of ice. Ice from water is preferred to gel packs because the gel packs are very hard when frozen and may break bottles, and also due to chemical contamination concerns with some sample types. If the ice was used earlier in the day during sampling, it is good practice to top off the ice bags with additional ice, pouring out any water, to ensure the samples stay cold during shipping.
5. Place all sample bottles in individual Ziploc bags. Place the bagged samples inside bubblewrap sleeves, or wrap with bubblewrap and secure with rubber bands or tape.
6. Put the bagged, bubble-wrapped samples and the double-bagged ice inside the trash bag in the cooler. Each sample should be in contact with ice. A common way to arrange the contents is to lay 2 bags of ice on the bottom of the cooler, put the samples on top of the ice, and then put additional bags of ice on top of the samples, and also vertically between the bottles. Arrangement may vary so that all samples will fit in the cooler.
7. Place an additional piece of bubblewrap on top of the samples.
8. Gather the ends of the trash bag together, fold over several times, and seal with tape. All samples and ice will be sealed in the trash bag, so any leaks should not escape the cooler.
9. If there is too much extra space, stuff bubblewrap around the trash bag to limit motion inside the cooler.

### **When using dry ice – How to prepare the samples and cooler for shipment:**

1. Acquire the appropriate training prior to field event.
  - a. If shipping by ground, the personnel packaging and shipping a package (e.g. cooler) containing dry ice do not have to have additional training.
  - b. If shipping by air, personnel who package, mark, label, load, document, or sign shipping papers for shipments containing dry ice must have training that satisfies hazmat training requirements in 49 CFR (Part 172), the IATA DGR, and the IMDG Code.
    - i. The Safety Unlimited training course DOT Hazmat: Carrier Requirements – Air/IATA provides training to meet this requirement  
<https://www.safetyunlimited.com/online-courses/DOT-Modal-Specific-Air.asp>
2. Unless otherwise specified by the lab, use 5lbs of dry ice when shipping bottles of groundwater samples, or 10lbs of dry ice when shipping biological samples.

- a. Dry ice will sublime from a solid to gas at a rate of 5-10 pounds (2.27 – 4.54 kg) per 24 hours when shipped in an appropriate insulated cooler.
- 3. Use paper bags or specific dry ice plastic bags (must be vented) to contain the dry ice. Dry ice pellets work better for distribution. Fill a bag with half of the dry ice and put it on the bottom of the cooler.
- 4. Put bubblewrap or other insulating material on top of the dry ice bag.
- 5. Put samples on top of the bubble wrap.
- 6. Put another layer of bubble wrap or other insulating material on top of the samples.
- 7. Fill another bag with the other half of the dry ice and put it on top of the top layer of bubblewrap.
- 8. Use additional insulating material to fill the cooler as much as possible.
- 9. Do not put everything in a trash bag and tie it off. The dry ice needs to vent to avoid the buildup of pressure as it sublimates.

**At the shipping location, with either ice type (for example, FedEx store):**

1. Sign off the chain of custody (COC) with the date and time you are relinquishing the samples to the shipping company. Include the airbill number/tracking number on the COC. It is good practice to take a picture of the COC and email it to the laboratory, along with the tracking number.
2. Place the signed COC in a Ziploc bag and tape it to the inside of the cooler lid.
3. Shut the cooler. Seal the cooler by wrapping filament tape around the cooler. Wrap the filament tape around the cooler on the right and left sides, with two layers of tape on each wrapping.
4. Cut two ~8-10 inch pieces of custody tape. Use the pieces of custody tape to seal the cooler lid to the cooler body, placing the pieces of tape at the front right and back left of the cooler.
5. Fill out the airbill, then keep the top copy of the airbill and return it to the Visa card holder who provided the shipping company account number. Scan a copy and email, if needed.
6. Attach the rest of the airbill to the cooler handle, or tape to the top lid of the cooler.
7. If shipping biological specimens (and assuming they are non-infectious), put a label on the cooler that says “exempt animal specimen.” This label can simply be a piece of paper taped to the cooler. Put on the same side as any other labels.

**Additional shipping steps if shipping with dry ice:**

1. Confirm that the carrier location accepting dry ice shipments; many don't. Often airport locations do.
2. Make sure to not tape around the seal between the lid and cooler body, to allow venting. Additionally, make sure the cooler spout remains open to allow venting.
3. The FedEx label needs to specify the amount of dry ice in the cooler at time of shipment, in kg (4.55 kg for 10 lb).
4. Put a Class 9 Dry Ice diamond placard label on the cooler.
5. Note - While dry ice is considered a dangerous good when shipped by air, a Dangerous Goods Shippers Declaration is not required (assuming there are no other types of dangerous goods in the shipment).
6. If shipping via UPS, they require an additional UPS Dry Ice label. Shipments of dry ice and other dangerous goods without an approved contract with UPS are prohibited. Shipper must establish contracted services with UPS in order to ship dangerous goods.